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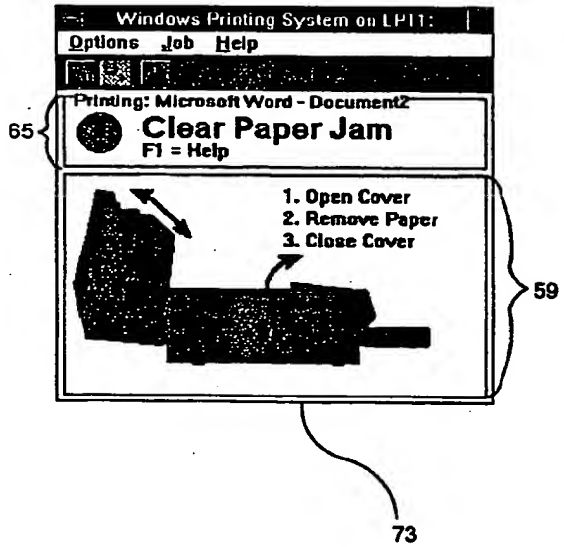

(57) Abstract

A computer system having a visual display indicating the status of an attached printer is disclosed. The visual display allows the user to determine various status states of the attached printer without physical examination of the printer itself. Printer states requiring user intervention, and printer states not requiring user intervention, are disclosed. In a preferred embodiment, the computer system displays a Printer Status window which both graphically and textually indicates the printer state. When printing, a graphical representation of the attached printer is displayed within a portion of the Printer Status window, and is animated to represent the actual printing of a page. If an error occurs while printing, the Printer Status window preferably indicates the nature of the error, and the steps which must be performed (if any) to continue printing. When not printing, the user may determine the present status of the attached printer, and such information is preferably presented to the user in graphical form. The Printer Status window may be iconized by the user, and the corresponding icon also displays to the user the state of the attached printer.

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Description

PRINTER STATUS USER INTERFACE AND METHODS RELATING THERETO

Technical Field

This invention is generally directed to a user interface for a computer system, and more specifically, to a visual display indicating the status of a printer attached to the computer system.

Background of the Invention

A computer system displays information to the user by a visual display. The ability of a user to access the information quickly and conveniently is, in large part, dependent upon the ease by which the user may interact with the computer through its visual display. While a vast amount of information is commonly displayed on the visual display of a computer system, the status of certain peripheral components of the computer system, including attached printers, are not accessible to the user through the visual display of the computer system. Rather, the user must examine the printer itself to determine its status. For example, if a printer lacks the correct size of paper or has a paper jam, this information can only be gleamed from an examination of the printer itself. When the printer is located at a location remote from the computer system, the user must travel to that location to determine the printer status.

Accordingly, there is a need in the art for a computer system having a visual display which provides the user information as to the status of an attached printer, without requiring that the user physically examine the printer itself.

Summary of the Invention

It is an object of the present invention to provide a computer system having a visual display which informs the user as to the status of an attached printer. The present invention fulfills this objective, and provides further related advantages.

In one embodiment, the present invention discloses a method in a computer system having a visual display device for displaying a state of an attached printer. The information displayed on the display device includes, but is not limited to, the following User Intervention Required printing states: Cover Open, Paper Out, Wrong Paper Loaded, Paper Jam, Manual Feed, Manual Duplex, Communications Error and Engine Error. Similarly, User Intervention Not Required printer states includes, but is not limited to: Normal, Toner Low, Low on Printer Memory and Printer Changed. Preferably, the state of the attached printer is displayed in a Printer Status window.

In a further embodiment, there is disclosed a method in a computer system having a display device and an attached printer, wherein a graphical representation of the attached printer, and the state thereof, is displayed on the display device. Preferably, the graphical representation indicates the physical characteristics of the printer, including animation of the passage of paper through the attached printer when printing.

In still a further embodiment, a method in a computer system having a display device is disclosed wherein the user may selectably control the attributes of an attached printer by selection of an appropriate portion of a graphical representation of the printer displayed on the display device. The graphical representation of the attached printer is displayed on the display device such that the state of the printer corresponds, in real time, to its graphical representation upon the display device.

Brief Description of the Drawings

Figure 1 illustrates a computer system of the present invention with a printer attached thereto.

Figure 2(a) illustrates a portion of the display screen of the computer system of Figure 1. Figure 2(b) depicts the same portion of the display screen as Figure 2(a), but with the remainder of the computer system (i.e., the article of manufacture) illustrated with cross-hatched lines.

Figure 3 illustrates a Printer Setup dialog box.

Figure 4 illustrates a Print Manager dialog box.

Figure 5 illustrates a Printer Status window for the Normal printer state.

Figure 6 illustrates a Printer Status window for the Low Memory printer state.

Figure 7 illustrates a Printer Status window for a Paper Jam printer state.

Figure 8 illustrates bitmaps displayed within the Printer Status window for certain printer states.

Figure 9 illustrates bitmaps displayed within the Printer Status window for an HP LaserJet Series II printer.

Figure 10 illustrates bitmaps displayed within the Printer Status window for an HP LaserJet Series IID printer.

Figure 11 illustrates bitmaps displayed within the Printer Status window for an HP LaserJet Series III printer.

Figure 12 illustrates bitmaps displayed within the Printer Status window for an HP LaserJet Series IIID printer.

Figure 13 illustrates bitmaps displayed within the Printer Status window for an HP LaserJet Series IIP, IIP+ and IIP without LC tray printers.

Figure 14 illustrates bitmaps displayed within the Printer Status window for HP LaserJet Series IIP, IIP+ and IIP with LC tray printers.

Figure 15 illustrates icons of the Printer Status window.

Figure 16 is a block diagram illustrating a preferred Queue Processor and a printer driver.

Figure 17 is a state diagram illustrating the states of the display PSW module.

Figure 18 is a flow diagram of a window procedure for the display PSW module.

Figure 19 is a flow diagram of the function that processes a new job message.

Figure 20 is a flow diagram of the function that processes a job done message.

Figure 21 is a flow diagram of the function that processes a change button message.

Figure 22 is a flow diagram of the function that processes a kick page message.

Figure 23 is a flow diagram of the function that processes a timer message.

Figure 24 is a flow diagram of the function that processes a timeout message.

Figure 25 is a flow diagram of the function that processes a display message.

Figure 26 is a flow diagram of the function that processes an information update message.

Figure 27 is a flow diagram of the function that processes a feeder change message.

Figure 28 is a flow diagram of the function that processes an error message.

Figure 29 is a flow diagram of the function that processes a restore message.

Detailed Description of the Invention

The present invention discloses a user interface for a computer system which provides information to the user regarding the status of an attached printer. As used herein the term "attached printer" means that the computer system and the printer are connected by, for example, a parallel interface, a serial interface, or a network. The connection between the computer system and the printer must permit bi-directional I/O. Suitable system architecture for a host computer-printer system is disclosed in U.S. Serial No. 07/911,767, filed July 10, 1992, and incorporated herein by reference. A preferred embodiment of the present invention executes in conjunction with the Windows operating system, which is described in Programming Windows 3.1, by Charles Petzold, published by Microsoft Press, 1992, which is hereby incorporated by reference. Appendices A and B describe aspects of the present invention in further detail.

Prior to this invention, a user of a computer system would have to examine the printer itself to determine its status. For example, when the attached printer is a Hewlett Packard (hereinafter "HP") laser printer (such as a LaserJet Series II, Laser Jet IID, LaserJet IIP, LaserJet III, LaserJet IIID, LaserJet IIIP, LaserJet IIP+), printer error status (to a limited extent) are displayed on the control panel located on the face of the printer itself. The state of the printer is not, however, displayed on the visual display of the computer system. In this invention, the visual display presents information regarding the printer state to the user by displaying a Printer Status window which provides up-to-date printer status of the attached printer. Thus, the user need not physically inspect the printer to determine its status.

The Printer Status window is displayed to the user on the visual display of the computer system. Referring to Figure 1, computer (10), keyboard (12), pointing device

(14), visual display (16), visual display screen (18) and attached printer (20) are illustrated. In Figure 2(a), computer (10), visual display (16) and visual display screen (18) are illustrated in combination with an area (30) of the visual display screen which contains information (not shown) relating to the status of the attached printer. Figure 2(b) represents a cross-hatched representation of Figure 2(a), and illustrates the area (30) as it appears on an article of manufacture.

The Printer Status window is displayed within the area (30) of Figures 2(a) and (b), or alternatively may be displayed full screen. The Printer Status window displays the current status of an active printer job. If an error occurs while printing or if user intervention is required, the Printer Status window is displayed on the visual display. When the error is corrected, the window preferably returns to its previous state. The Printer Status window is preferably not system modal, and the user should be able to switch to another application and continue working. As discussed in greater detail below, printer states which require user intervention (such as paper out or cover open) should have priority over merely informative messages (such as toner low).

In a preferred embodiment of this invention, the computer system employs a number of components to generate the user interface. In addition to the Printer Status window discussed above, additional components of this invention include a Printer Setup dialog box, a Printer Manager dialog box, and a Queue Processor.

The Printer Setup dialog box configures the properties of the attached printer. Changes made in this dialog box affects the print job. Figure 3 illustrates a preferred Printer Setup dialog box which appears on the screen of the visual display when the user chooses the appropriate command (such as "Printer Setup"). The current printer status is depicted within a portion (31)

of the Printer Setup dialog box. In Figure 3, the attached printer is depicted by a corresponding visual image of the printer (33) (also referred to herein as a printer "bitmap"), including a graphical representation of the paper source tray (35) currently in the printer. The user may select the paper size using either the paper size bitmaps (37), or the paper size combo box (39). The paper size bitmaps are selectable using the mouse pointer, and the combo box can selected with either the keyboard or mouse. The currently selected paper size is shown in the combo box and, if the selected paper size has an appropriate bitmap, that bitmap and the corresponding text are preferably emphasized. In the practice of the present invention, if the user selects or clicks the mouse anywhere in the paper source tray of the printer visual image (33), that tray is selected. For example, if the attached printer has two paper source trays, the graphical representation of the printer within the Printer Setup dialog box illustrates a printer having two paper trays, and selection of either tray with the pointer activates that the selected paper tray choice. Similarly, if the user clicks the mouse on the front of the visual image of the printer (33), manual feed is selected, and if the user clicks anywhere else on the visual image of the printer, "Any Source" is selected. In a preferred embodiment, when the user moves the cursor over the selectable printer bitmap, the standard arrow pointer changes to a pointer in the shape of a "hand-with-finger" pointer display. In short, the user may selectably control various printer setup options by appropriate selection with the portion (31) of the Printer Setup dialog box, thus permitting user control of printer functions by selection within the visual display of the printer image.

Additional features of the Printer Setup dialog box preferably include a textual portion (32) which notifies the user what selected paper size is currently in the

printer. In other words, the printer status (in this case whether one or more paper source trays are loaded in the attached printer) is communicated to the user via the user interface, rather than the user physically inspecting the attached printer. In addition, the visual image of the printer (33) preferably changes according to the actual state of the printer in real time. For example, if the user removes the paper source tray from the printer while the Printer Setup dialog box is active, the visual display of the printer changes to reflect this new printer state (e.g., the printer bitmap displays a printer lacking a paper tray). Different visual displays of the printer may be displayed depending upon the attached printer. For example, available visual displays for a two tray printer may represent the following states: no tray (e.g., printer with all trays removed), tray 1 (e.g., printer with only the top tray), tray 2 (e.g., printer with only the bottom tray), both tray 1 and 2 (e.g., printer with both trays), manual feed (e.g., printer with paper being inserted) and not available (e.g., printer have a "grayed" appearance denoting the absence of an attached printer or absence of communication between the computer system and printer).

In addition to the Printer Setup dialog box, the visual display of the present invention also displays a Print Manager dialog box to inform the user of the current status of an active printer and printing job. As illustrated in Figure 4, a preferred embodiment of the Print Manager dialog box is depicted. The Print Manager dialog box contains a button (41), as well as an menu option command to this effect listed under the View command of the Print Manager menu bar, which activates the Printer Status window. The Printer Status window is available when there is bi-directional I/O between the computer system and printer. The Printer Status window appears on the visual display of the computer system when

selected by the user as indicated above, or when the user has selected the Automatically Display Printer Status option and the user prints a document, an error occurs, or when user action is required. The Printer Status window preferably disappears (i.e., is not displayed on the visual display) when the user explicitly closes the window, when the print job ends if the user has selected the Automatically Display Printer Status option and the print job ends (and the user has not interacted with the window), the error state ends, or the manual action is performed by the user. The Printer Status window preferably appears as an icon when the user explicitly minimizes the window, the user starts the Printer Status window and the last state of the window was iconized, or the window appears because of the Automatically Display Printer Status option and the last position the user moved the window to was an icon. In addition, the Printer Status window preferably appears full-sized when the user explicitly restores the window, the user selects the Printer Status window and the last position the user placed the window was full size, an error occurs, or manual action is required.

As used herein, the term "printing" means that a printing job is being sent to the printer by the computer system, and there are no errors which prevent the job from completing. In the practice of the present invention, sub-states exist during printing which, when they occur, are displayed to the user by the visual display, but printing continues (i.e., these sub-states do not stop printing, and are referred to herein as User Intervention Not Required states). These sub-states are displayed with the following precedence (from most important to least important): Printer Memory Low, Printer Changed, Low Toner and Normal. For example, if the printer's memory is low and the toner is also low, the Printer Memory Low state is displayed. If one of these sub-states is entered

when the Printer Status window is iconized, the icon preferably begins blinking. The icon stops blinking when the window is opened or the job completes. If a Printer Status window other than Normal is displayed, the user can click the window with the mouse or press the Enter key to display the Normal Printer Status window.

The visual display of the Printer Status window for the Normal printing state is illustrated in Figure 5, and is displayed when printing is proceeding normally and none of the other printing sub-states apply. The Normal Printer Status window preferably displays a delete button (51), pause button (52) and a resume button (53). In addition, printing information may be displayed in the Job Information Group Box (55), and a Status Bar (57) illustrates job completion. This window also displays a visual image of the printer (59). If printing sub-states apply such as Low Toner, Low Memory, or Printer Changed, this information is displayed within the Job Information Group Box. For example, if the attached printer is low on memory (i.e., the print job requires additional memory to print without degradation), the Printer Status window illustrated in Figure 6 is displayed, with the appropriate information text displayed in the Job Information Group Box (65), as well as an information icon (66). Similar Printer Status windows are displayed for the Toner Low and Printer Changed states.

As printing progresses, the status bar (57) of Figures 5 and 6 indicates the percentage of pages that have been printed for the printing job. The status bar initially is empty and is entirely filled when the last page of the job exits the attached printer. In addition, the visual image of the printer (59) of Figure 5 and 6 is preferably animated to depict the progression of printing. For example, referring to Figure 5, the sheet of paper within the printer is depicted as a cross-sectional view of a piece of paper (54). During printing, this piece of

paper is shown to move through the printer from the paper tray source to the top of the printer for removal as a printed sheet. The Printer Status window may also display the number of printed pages (82), the pages being printed (83), and the pages ready to be sent to the printer (not shown) by the computer system.

In contrast to printer states discussed above which do not require user intervention, a User Intervention Required state necessitates user intervention. This state includes, but is not limited to, the following sub-states: Cover Open, Paper Out, Wrong Paper Loaded, Paper Jam (several types), Manual Feed, Manual Duplex, Communications Error and Engine Error. When user intervention is required, the User Intervention state is entered, and the user must perform some task to continue the printing job. As noted above, these states are typically printing errors, but may also include prompting for insertion of a page when manually duplexing.

When the User Intervention Required state is entered because of an error, an appropriate Printer Status window is displayed, the queue is paused, and the Pause and Resume buttons on the toolbar of the Printer Status window are disabled the user should, however, be permitted to cancel the job at this time using the Stop button). When the error is fixed, the Printer Status window corresponding to the specific User Intervention Required state is replaced with an appropriate Printer Status window for a User Intervention Not Required state. No user interaction other than fixing the error is required to terminated this dialog except the manual operation(s). When the user Intervention Required state is entered due to manual operation (e.g., manual duplexing or manual feeding), the queue is paused and the Pause button is disabled. The user can cancel the job using the Stop button, or indicate that action has been taken by clicking on the Resume button or pressing the enter key. When the user continues

the printing job, the appropriate Printer Status window for the User Intervention Not Required state is displayed.

For example, if there has been a paper jam in the attached printer, the Printer Status window of Figure 7 is displayed. An error icon/message is displayed in the Job Information Group Box (65), as well as an appropriate visual image of the printer (59) indicating the nature of the error. The location of the paper jam (73) is indicated (preferably in red) within the bitmap of the attached printer which is displayed within the appropriate Printer Status window (in this case, the Paper Jam Printer Status window), and the solution to the error (i.e., opening the printer cover, removing the jammed paper, and closing the cover) is indicated (preferably in green).

Alternatively, the Pause/Resume buttons may function as a toggle--that is, if the printer is not paused, the Pause button is up and the Resume button is down. The pause/resume state of the printer may be changed by the Print Manager's Pause/Resume buttons and menu items, the Printer Status window's Pause/Resume buttons and menu items, and the printer's front panel Online and Continue buttons. The pause/resume state is normally as last set by the user, and can be changed by the user at any time. If the printer goes into a state where the only possible user response is to resume printing, the system will automatically change to the paused state. Manual duplexing and manual feeding are examples where the user must tell the system to resume printing by the Resume button. In addition, there are cases where resuming printing is only one of the possible responses. For example, if the printer is currently loaded with legal paper, but the document being printed requires letter paper, the system will go into the paused state to allow the user to react. The user has two choices: the user may put letter paper into the printer, in which case the printer will automatically go back into the resumed state

and continue printing; or the user may press the Resume button to tell the system that it should go ahead and print the document on the currently loaded paper (called "coercing" the paper size). Another example is when a print job was created specifying the upper tray of the printer which has since gone empty. The user may fill the upper tray or press Resume to coerce the Tray Search Range to allow the printer to print from the lower tray.

The various User Intervention Required sub-states are indicated to the user by displaying a different status picture and error/icon message within the Printer Status window for each of the sub-states. For example, if the printer is out of paper, the Paper Out Printer Status window depicts the visual image of the printer as illustrated in Figure 8(a). Similarly, the Cover Open and Wrong Paper Loaded sub-states may be indicated to the user by displaying the bitmaps illustrated in Figures 8(b) and (c), respectively. If an Engine Error state is encountered, the visual display of the printer may be replaced with Figure 8(d) to indicate the necessary action require by the user (e.g., consult the printer manual and/or call for printer service). Alternatively, if data cannot be sent to the attached printer due to a communication error, the Printer Status window may display the visual display of Figure 8(e), which graphically represents the suggested corrective action.

As mentioned above, the visual image or bitmap of the printer displayed within the Printer Status window will vary depending upon the attached printer. For example, the bitmap for an attached HP LaserJet Series II printer is different than the bitmap for a Series III printer. In the practice of the present invention, the bitmap will indicate to the user the type and model of attached printer, as well as status attributes thereof. Thus, if the attached printer has two paper source trays, the bitmap displayed within the Printer Status window will so

indicate. Representative examples of bitmaps for various HP LaserJet Series printers are illustrated in Figures 9 through 14. Specifically, Figure 9 illustrates bitmaps displayed within the Printer Status window for an HP LaserJet Series II printer, Figure 10 illustrates bitmaps for an HP LaserJet Series IID printer, Figure 11 illustrates bitmaps for an HP LaserJet Series III printer, Figure 12 illustrates bitmaps for an HP LaserJet Series IIID printer, Figure 13 illustrates bitmaps for an HP LaserJet Series IIP, IIP+ and IIP without LC tray printers, and Figure 14 illustrates bitmaps displayed within the Printer Status window for HP LaserJet Series IIP, IIP+ and IIP with LC tray printers. Similarly, representative examples of bitmaps for various HP LaserJet Series printers, and displayed within the Printer Setup dialog box, are illustrated in Appendix A at pages 137-147.

In a preferred embodiment, the Printer Status window may be iconized by the user and, when iconized, depicts (in graphical form) the attached printer. Examples of such icons are presented in Figure 15. Specifically, Figure 15(a) illustrates icons which appear on the visual display when the printer is in the Paused state, and Figure 15(b) illustrates suitable icons when in the Printing state. Preferably, the icons for the Printing state have a bar above the printer which fills from left to right as the job is printed. The percentage of the bar filled represents the percentage of pages that have actually finished printing, with the bar empty until the first page exists the printer, and the bar filled entirely when the last page exits the printer. It should also be understood that each of the icons depicted in Figure 15 are displayed by the computer system in an area (90) of the visual screen (18) as indicated in Figure 15(c). Thus, each and every icon of Figure 15 is separately represented within area (90) of Figure 15(c)(with the

remainder of the computer system depicted with cross-hatched lines). Figure 15(d) illustrates User Intervention Required icons, Figure 15(e) illustrates Printing Done icons, Figure 15(f) illustrates Status Not Available icons, and Figure 15(g) illustrates printer Idle icons.

User selectable sounds may also be associate with certain printer states. For example, if a paper jam occurs during printing, the computer system may indicate this condition with a suitable computer generated sound. Alternatively, a computer generated voice may tell the user the printer state.

In a preferred embodiment, a Queue Processor (QP) computer program checks the printer status, displays the Printer Status window (PSW) and dialog boxes, and controls the printing of data. The Queue Processor preferably executes in response to requests from the Windows Print Manager. Figure 16 is a block diagram illustrating a preferred Queue Processor and a communications driver. The Queue Processor 1600 receives requests to print data, referred to as a "job," and controls the printing of the data and displaying of the Printer Status window. The Queue Processor sends the print data to the communications driver 1604 and receives status information from the communications driver. The printer driver interfaces with the printer through a communications port. The communications driver receives blocks of print data and status requests from the Queue Processor and sends them to the printer over the communications port. In response to these status requests, the communications driver also receives status information from the printer over the communications port and sends it to the Queue Processor. The communications driver also receives, from the printer, signals indicating that the printer's status has changed (the "Status Changed" message) or that the printer has started a page in motion (the "Kick Page" message) which

are relayed to the Queue Processor via the Windows PostMessage mechanism.

The Queue Processor 1600 comprises a control printing module 1601, a display PSW module 1602, and a get status module 1603. The control printing module 1601 stores the print data in blocks in a format compatible with the communications driver and sends the blocks to the communications driver. The control printing module also stores status information (e.g. page number being printed) relating to the print job. The display PSW module 1602 controls the display of the Printer Status window. The display PSW module receives status information from the communications driver and the control printing module and controls the formatting and displaying of the status information. The get status module 1603 receives requests from the control printing module and the display PSW module to retrieve printer status information. The get status module requests the status from the communications driver and returns the status to the requesting module. In a preferred embodiment, the printer status information is stored in a data structure that is accessible by each module. Also, in a preferred embodiment, the Queue Processor is implemented as functions stored within a dynamic link library and executes under the Windows operating system. The Windows Print Manager invokes the control printing module to print data. The Print Manager also periodically invokes the control printing module to send data to the printer and to update the Printer Status window. The display PSW module is preferably implemented as a Windows window procedure. One skilled in the art would appreciate that the control printing module, the display PSW module, and get status module could be implemented as separate tasks when executing under a multitasking operating system. In the following, the display PSW module is described as implemented as a window procedure.

Figure 17 is a state diagram illustrating the states of the display PSW module. The display PSW states track the progress of a print job so that the display PSW module can update the Printer Status window in an animated manner. The labeled lines between the states indicate events (messages) that trigger a state transition. The ready state 1701 indicates that no job is currently being printed. The displayed state 1702 indicates that a job is being printed. The frame1 1703, frame2 1704, frame3 1705, and frame1&3 1706 states track the location of the pages as they progress through the printer. The frame1, frame2, and frame3 states represent three different locations of a sheet of paper as it is travels through the printer. The frame1&3 state indicates that one sheet is at the first location and another sheet is at the third location. The display PSW module updates the Printer Status window as the state changes to effect an animated presentation. The display PSW module uses a timer to estimate the location of the sheet of paper as it moves through the printer. In an alternate embodiment, the printer provides information as to the location of the sheet as it moves through the printer. The display PSW module then displays the actual location, rather than an estimated location. The animate paused state 1707 indicates that the printer is currently paused. A printer pauses typically because the printer goes off-line (e.g., the user presses the "off-line" button of the printer) or because a user activates the Pause button in the Printer Status window. The display PSW module is initially in the ready state. When the display PSW module receives a new job message, it transitions to the displayed state. A kick page message (a signal from the printer indicating that the printer is starting to print a new page) causes the display PSW module to transition from the displayed state to the frame1 state. The displayed PSW module transition through the frame1, frame2, frame3, and frame1&3 states base on

timing information and kick page messages. The animate paused state indicates that the printing has paused. The printing resumes when the resume button is activated or the printer is put on-line.

Figure 18 is a flow diagram of a window procedure for the display PSW module. The window procedure is invoked whenever a message is sent to the display PSW module. The overall structure of the display PSW module corresponds to well-known window procedure structures. As shown in step 1801 through 1804, the window procedure determines which message is received and performs functions corresponding to the message. The messages are sent by the control printing module, the get status module, and the communications driver. Messages sent from the communications driver correspond to changes in the printer status. The following table describes messages supported in a preferred embodiment.

Message Name	Description
Change Button	This message indicates that the user has selected the pause or resume button or the printer has gone off-line.
Display	This message indicates that the user has requested that the printer status window be displayed.
Error	This message indicates that either the Queue Processor has experienced a communications error or that the printer has indicated an error.
Feeder Change	This message indicates that either the number of printer feeders has changed or a configuration of the feeders has changed.
Information Update	This message indicates that the number of pages in the job has changed.

Job Done	This message indicates that the printer has finished printing the job.
New Job	This message indicates that the Queue Processor has started a new print job.
Printed	This message indicates that the printer has incremented the number of pages printed.
Restore	This message indicates that the printer status has changed and there is no error.
Sent	This message indicates that the Queue Processor has sent all the data for the page to the printer.
Status	This message indicates that the printer status has changed to being either valid or not available.
Warning	This message indicates that the printer status has changed and warning status was sent by the printer

Figures 19 through 29 are flow diagrams of steps performed by the window procedure to process each message. The steps are illustrated as being implemented as functions that are invoked by the window procedure. Figure 19 is a flow diagram of the function that processes a new job message. In step 1901, if the current state is ready, then the function continues as step 1902, else the function returns. In step 1902, the function estimates the time to completion of the print job (as disclosed in U.S. Serial No. 07/912,098, filed July 10, 1992, and incorporated by reference herein). In step 1903, the function changes the state to the displayed state. In step 1904, the function updates the Printer Status window and returns. This function may employ existing window management techniques, such as those provided by the Windows operating system. The information needed to

update the display is gathered from printer status information, job status information, and user selections.

Figure 20 is a flow diagram of the function that processes a job done message. In step 2001, if the current state is displayed, then the function continues at step 2002, else the function returns. In step 2002, the function changes the state to ready. In step 2003, the function updates the printer status window and returns.

Figure 21 is a flow diagram of the function that processes a change button message. In step 2101, if a pause is indicated, then the function continues at step 2102, else the function continues at step 2104. In step 2102, the function sets the pause flag to true. The pause flag indicates that the printer has paused. In step 2103, the function updates the printer status window and returns. In step 2104, the function sets the pause flag to false. In step 2105, if the current state is animate paused, then the function continues at 2106, else the function continues at step 2108. In step 2106, the function changes the state to displayed. In step 2107, the function estimates completion time for the job. In step 2108, the function updates the Printer Status window and returns.

Figure 22 is a flow diagram of the function that processes a kick page message. In step 2201, if the current state is displayed, then the function changes the state to frame1 in step 2202 and continues at step 2207, else the function continues at step 2203. In step 2203, if the current state is frame 3, then the function changes the state to frame1&3 in step 2204 and continues at step 2208, else the function continues at step 2205. In step 2205, if the current state is animate paused, then the function changes the state to frame1 in step 2206 and continues at step 2207, else the function returns. In step 2207, the function estimates the time to completion

of the print job. In step 2208, the function updates the printer status window and returns.

Figure 23 is a flow diagram of the function that processes a timer message. A timer message is generated at a regular interval. The procedure uses this message to track the time in a state. When the display PSW module is in state for pre-defined length of time, then a timeout message is generated to effect a change in state. In step 2301, if the current state is animate paused, then the time values are not incremented and the function returns, else the function continues at step 2302. In step 2302, the function decrements the estimated time to completion of the job. In step 2303, the function decrements the time in the current state. When the state is changed the length of time for that state is set and this function decrements that length of time. In step 2304, if the time for the state has elapsed, then the function sends a timeout message to the window procedure in step 2305 and returns.

Figure 24 is a flow diagram of the function that processes a timeout message. In step 2401, if the current state is frame1, then the function changes the state to frame2 in step 2402 and continues at step 2411, else the function continues at step 2403. In step 2403, if the current state is frame2, then the function changes the state to frame3 in step 2404 and continues at step 2411, else the functions continues at step 2405. In step 2405, if the current state is frame1&3, then the function changes the state to frame2 in step 2406 and continues at step 2411, else the function continues at step 2407. In step 2407, if the current state is frame3, then the function continues at step 2408, else the function returns. In 2408, if the pause flag is true, then the function changes the state to animate paused in step 2409, else the function changes the state to displayed in step 2410. The function then continues at step 2411. In step

2411, the function updates the Printer Status window and returns.

Figure 25 is a flow diagram of the function that processes a display message. In step 2501, the function updates the Printer Status window and returns.

Figure 26 is a flow diagram of the function that processes an information update message. In step 2601, the function determines what new information should be displayed. In step 2602, the function updates the Printer Status window and returns.

Figure 27 is a flow diagram of the function that processes a feeder change message. In step 2701, the function determines the current feeder state. In step 2702, the function updates the Printer Status window and returns.

Figure 28 is a flow diagram of the function that processes an error message. In step 2801, the function determines the error type. In step 2802, the function updates the Printer Status window and returns.

Figure 29 is a flow diagram of the function that processes a restore message. In step 2901, the function determines the new status of the printer. In step 2902, the function updates the Printer Status window and returns.

While this invention has been shown and described with reference to certain preferred embodiments, it will be understood by those skilled in the art that various changes or modifications in form and detail may be made without departing from the spirit and scope of this invention.

Claims

1. A method in a computer system having a display device and an attached printer, the method comprising displaying on the display device a state of the attached printer.

2. The method of claim 1 wherein the state of the attached printer is displayed within a window appearing on the display device.

3. The method of claim 1 wherein the state of the attached printer is a user intervention not required state.

4. The method of claim 3 wherein the user intervention not required state is selected from the group consisting of Normal, Toner Low, Low Printer Memory and Printer Changed.

5. The method of claim 1 wherein the state of the attached printer is a user intervention required state.

6. The method of claim 5 wherein the user intervention required state of the attached printer is selected from the group consisting of Cover Open, Paper Out, Wrong Paper Loaded, Paper Jam, Manual Feed, Manual Duplex, Communications Error and Engine Error.

7. A method in a computer system having a display device and an attached printer, the method comprising displaying on the display device a graphical representation of a state of the attached printer.

8. The method of claim 7 wherein the graphical representation indicates the physical characteristics of the attached printer.

9. The method of claim 8 wherein the graphical representation animates the passage of paper through the attached printer.

10. The method of claim 7 wherein the graphical representation corresponds to the state of the attached printer in real time.

11. A method in a computer system having a display device and an attached printer, the method comprising selectably controlling printer attributes by selecting an appropriate portion of a graphical representation of the attached printer displayed on the display device.

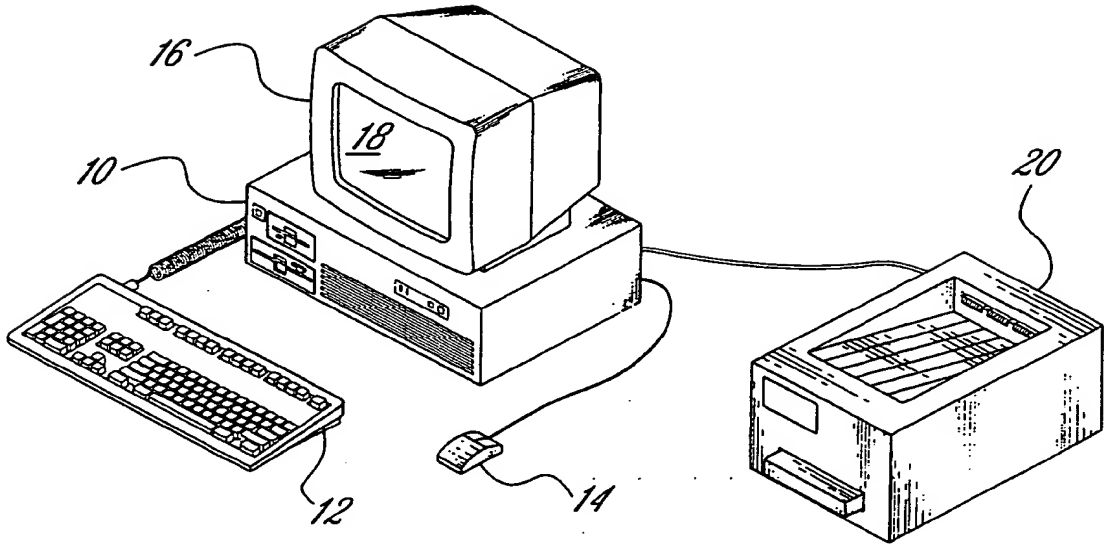


Fig. 1

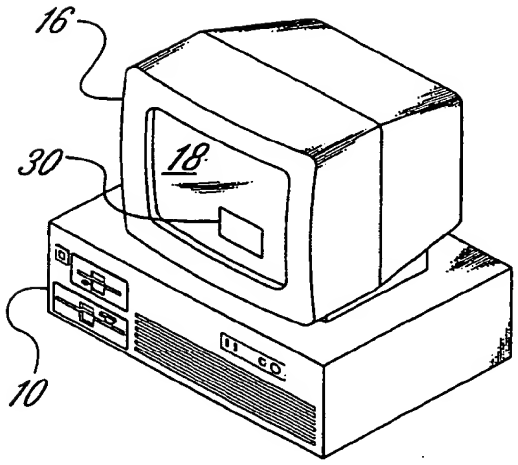


Fig. 2A

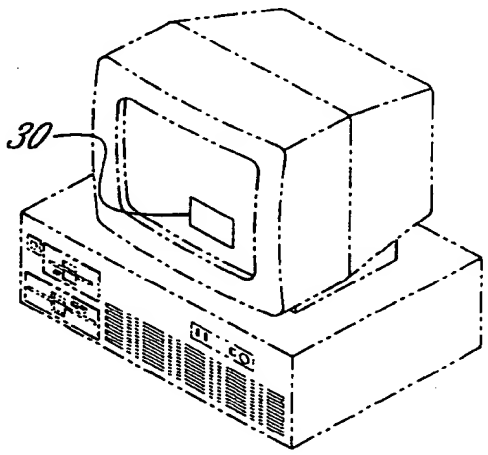
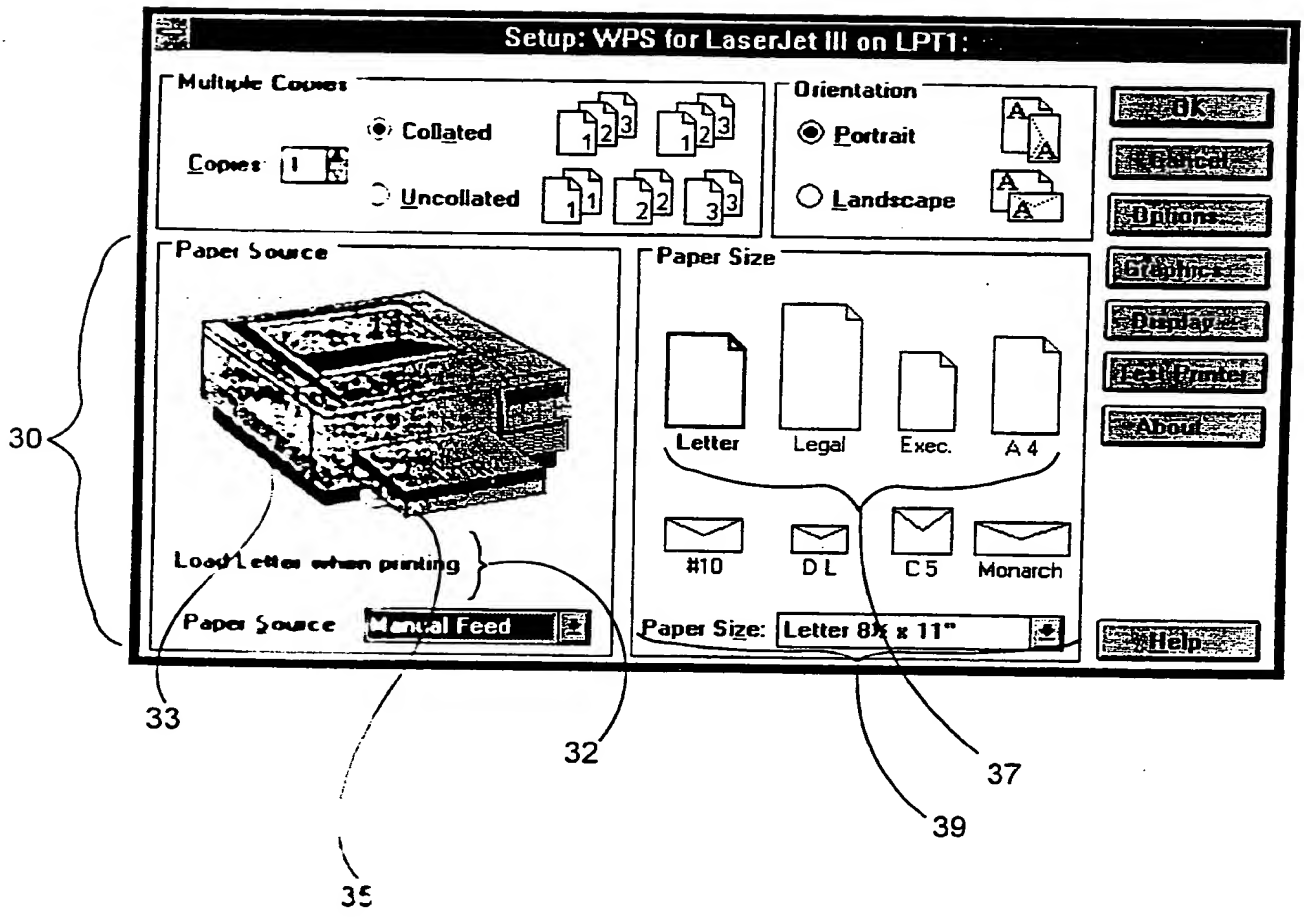


Fig. 2B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Copies: 1
Collated
Uncollated
Orientation
Portrait
Landscape
OK
Cancel
Options
Graphics
Display
Fonts
About
Help
Paper Source
Load Letter when printing
Paper Source: Manual Feed
Paper Size
Letter
Legal
Exec.
A4
#10
DL
C5
Monarch
Paper Size: Letter 8½ x 11"
30
33
32
35
37
39

Fig. 3

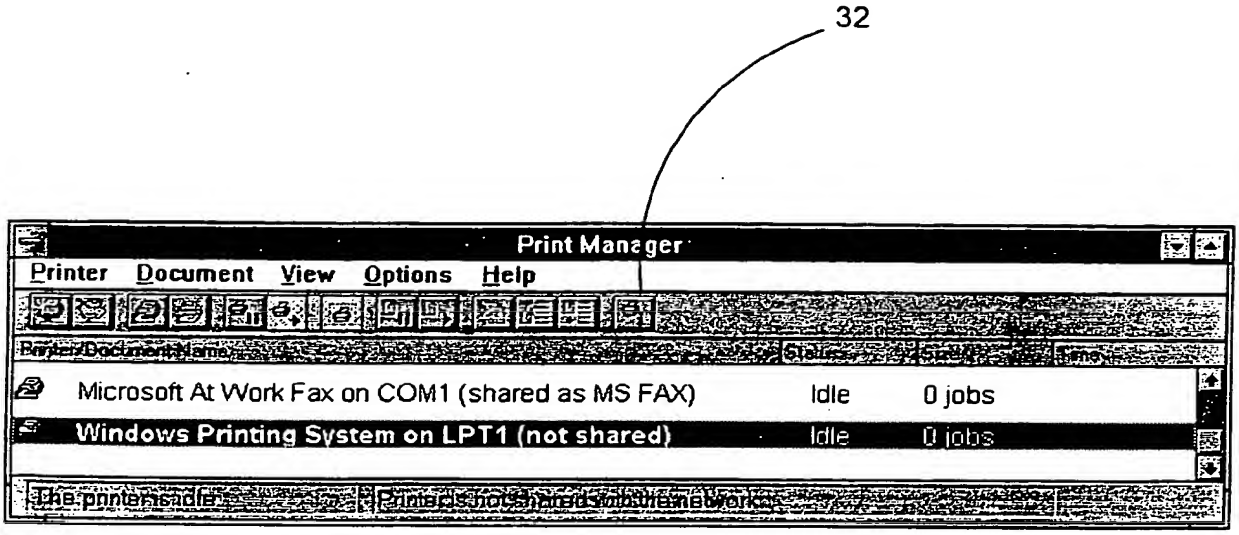
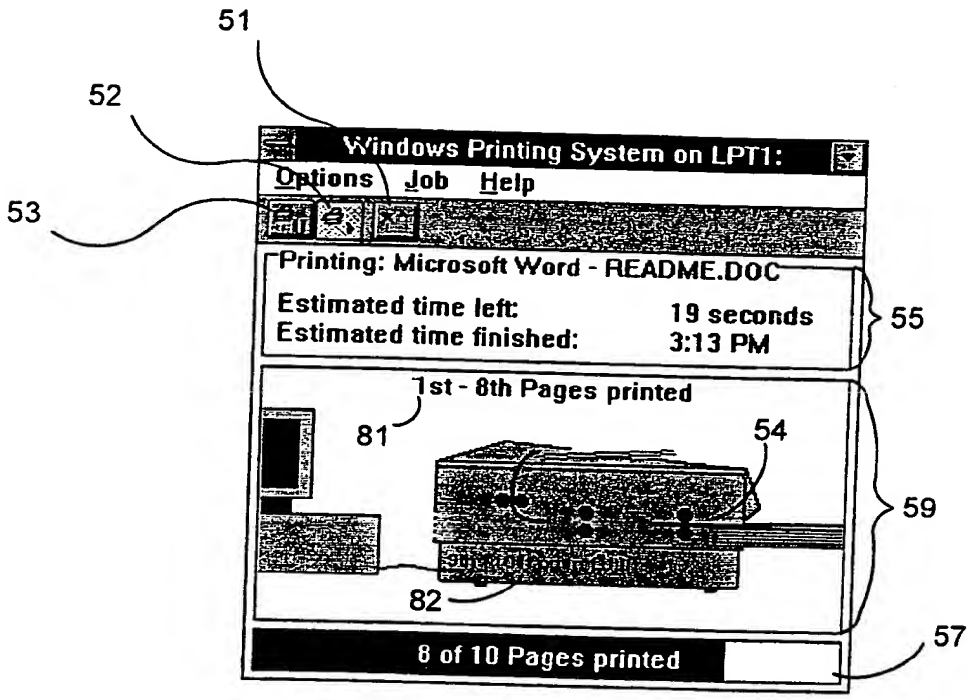


Fig. 4


51
52
53
Windows Printing System on LPT1:
Options Job Help
Printing: Microsoft Word - README.DOC
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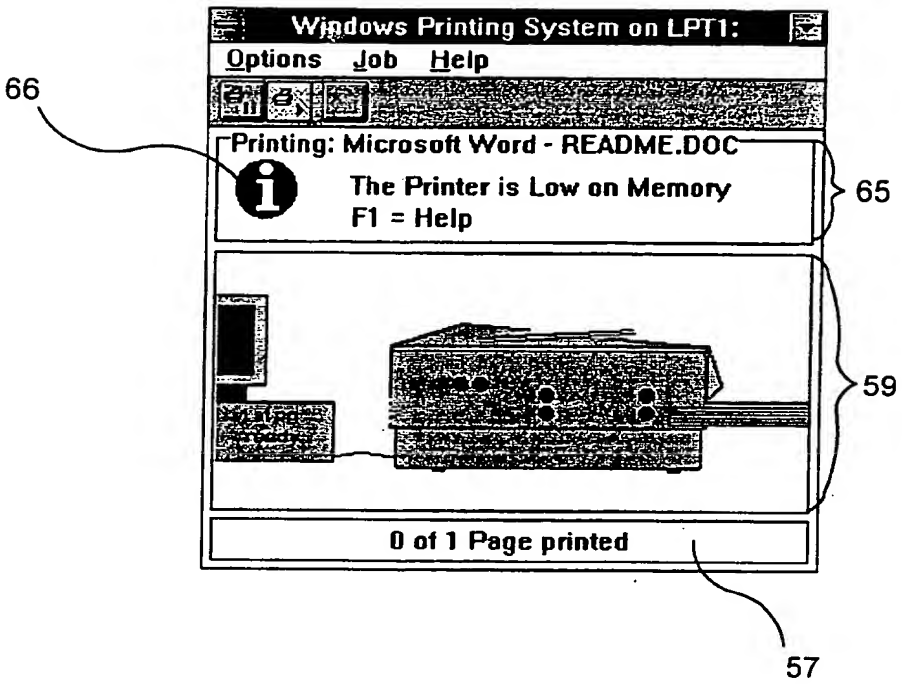
55
1st - 8th Pages printed
81
54
59
82
8 of 10 Pages printed
57

Fig. 5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Options Job Help
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Printing: Microsoft Word - README.DOC
The Printer is Low on Memory
F1 = Help
65
59
0 of 1 Page printed
57

Fig. 6

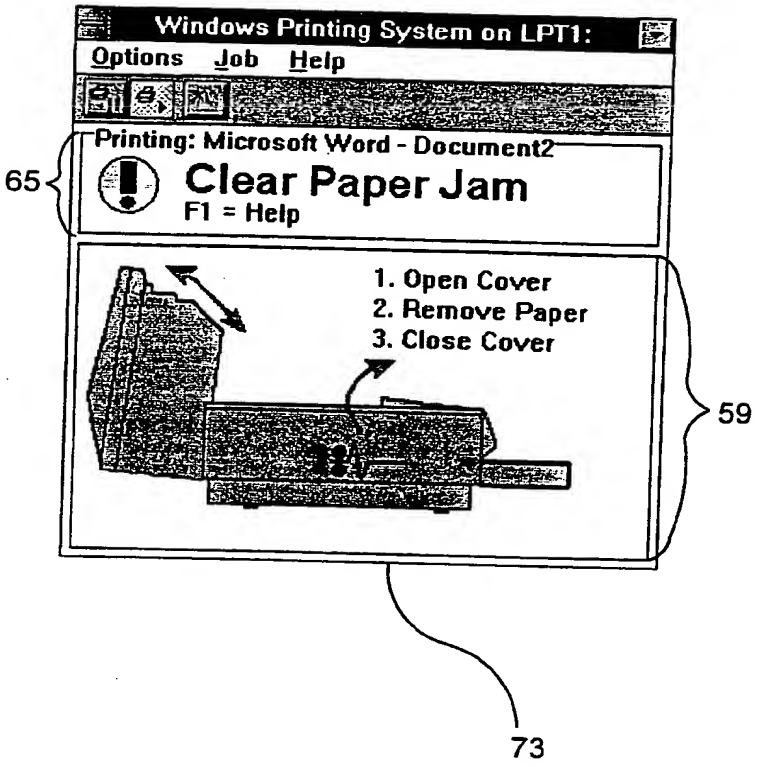

Windows Printing System on LPT1:
Options Job Help
Printing: Microsoft Word - Document2
Clear Paper Jam
F1 = Help
1. Open Cover
2. Remove Paper
3. Close Cover
65
59
73

Fig. 7

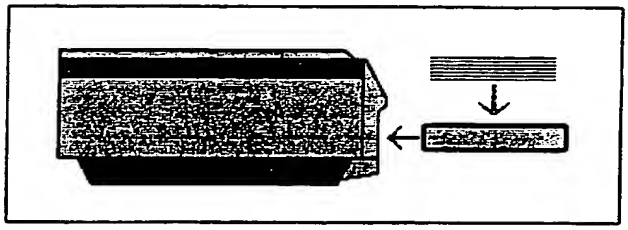


Fig. 8A

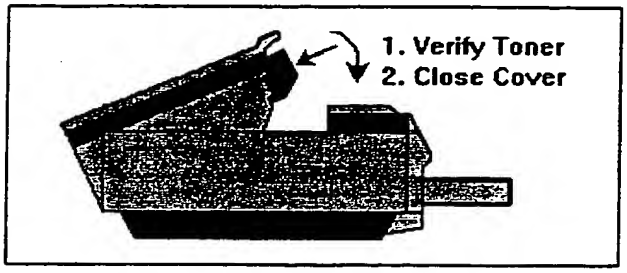


Fig. 8B

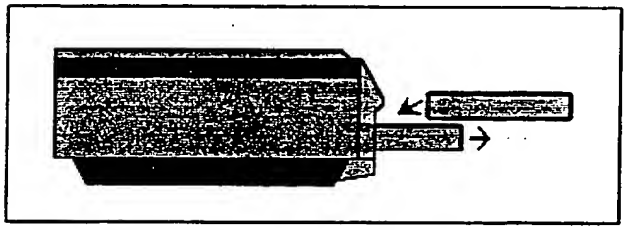


Fig. 8C

8/43

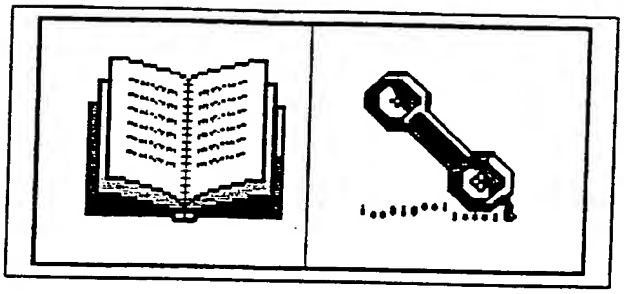


Fig. 8D

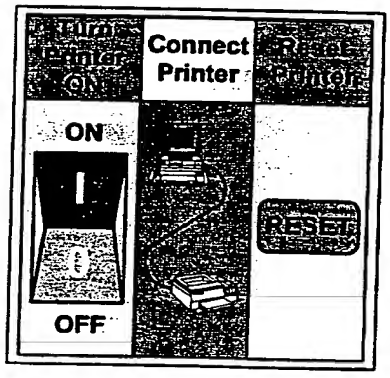
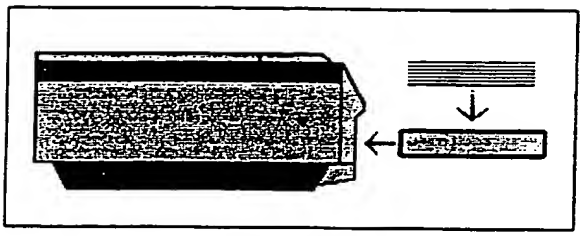


Fig. 8E



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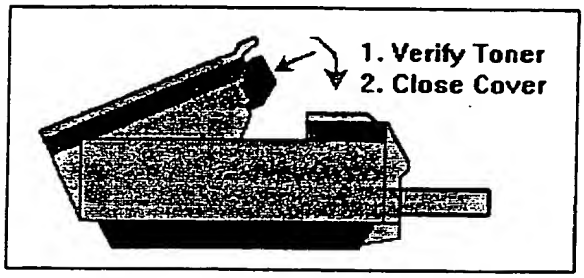

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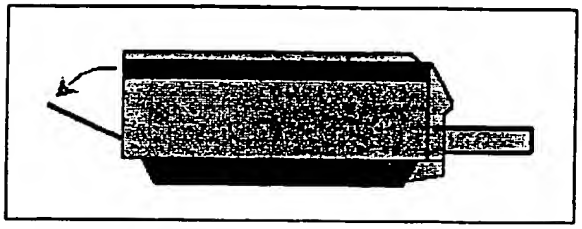

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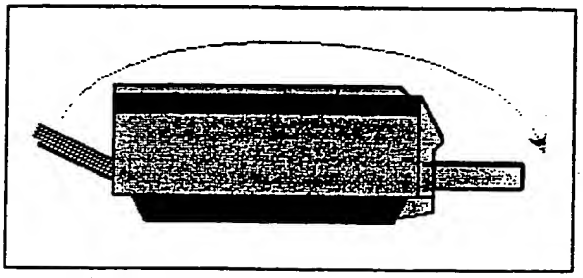
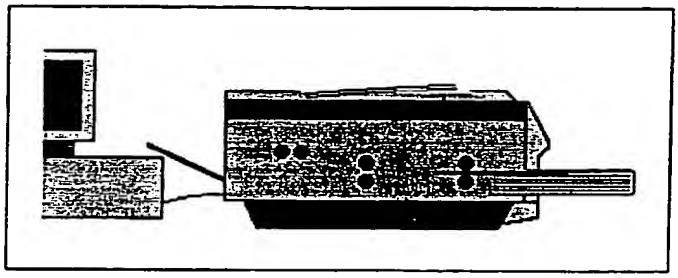
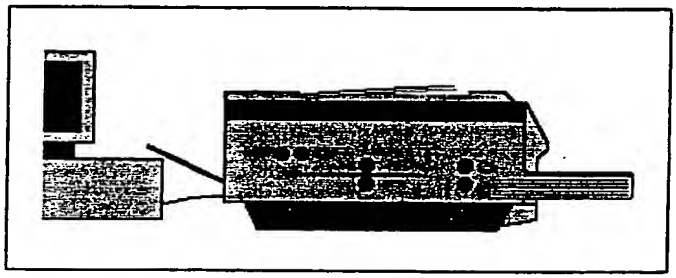


Series II Manual Duplex Bitmap

Fig. 9A



Series II Duplex Position 1 Bitmap



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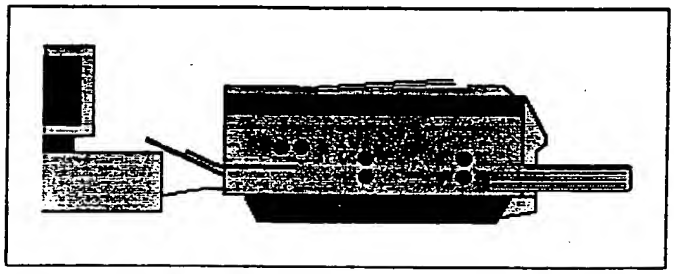
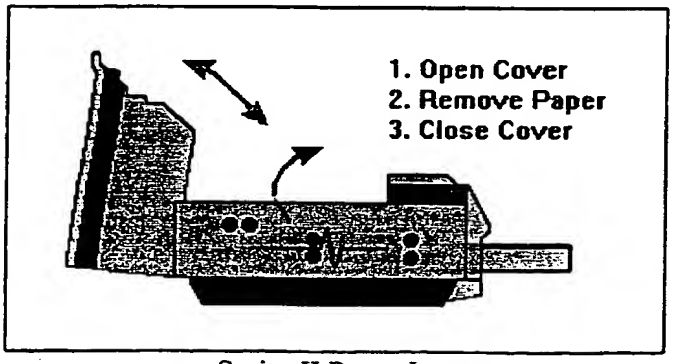
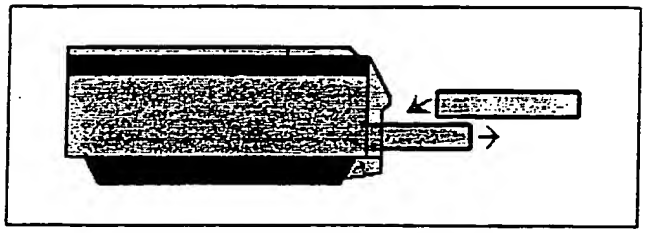


Series II Duplex Position 3 Bitmap

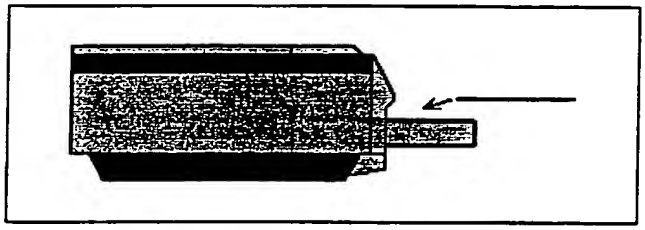


Series II Paper Jam

Fig. 9B



Series II Wrong Tray Bitmap



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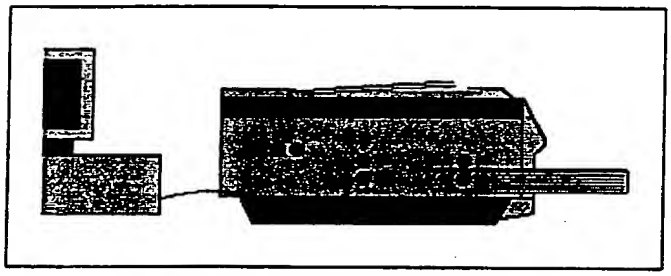

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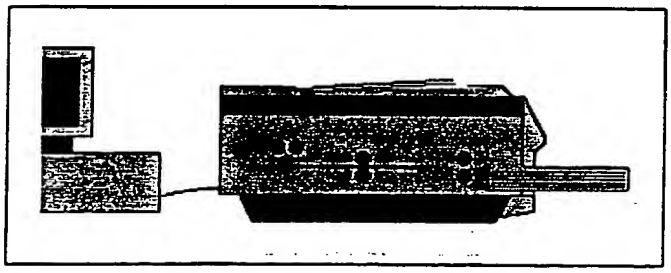

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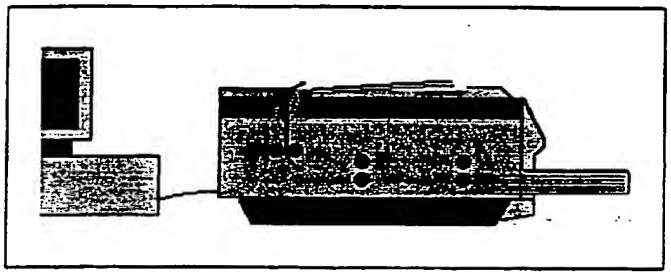

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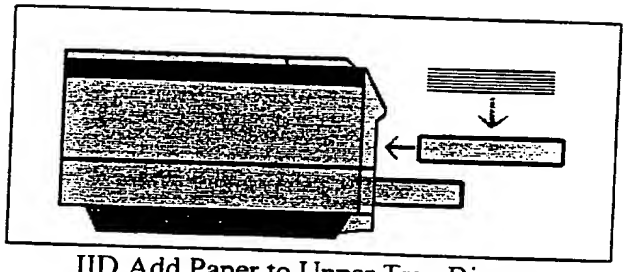
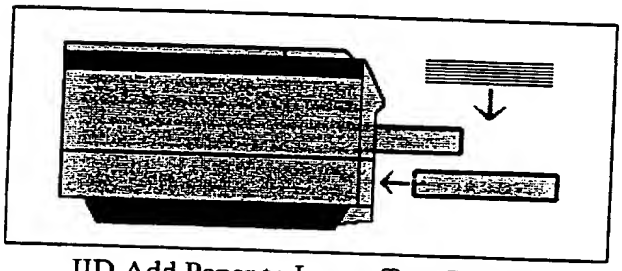
Fig. 9C



IID Add Paper to Upper Tray Bitmap



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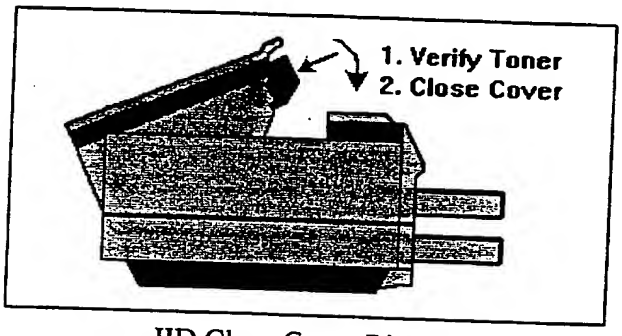
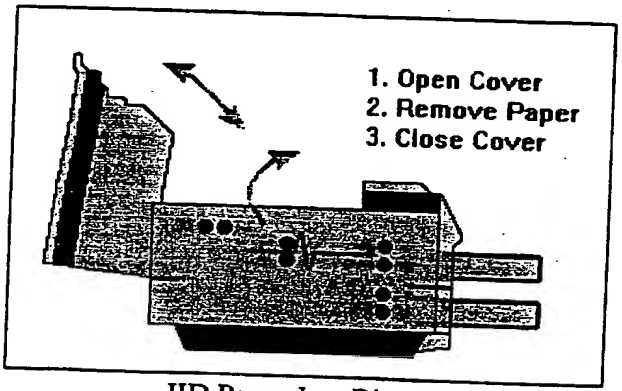
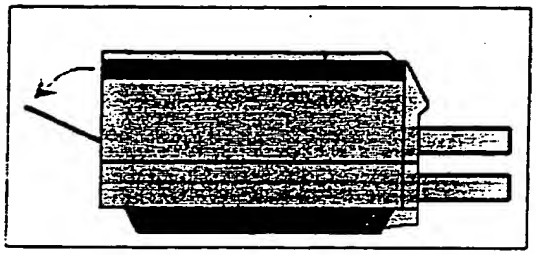


IID Close Cover Bitmap



IID Paper Jam Bitmap

Fig. 10A



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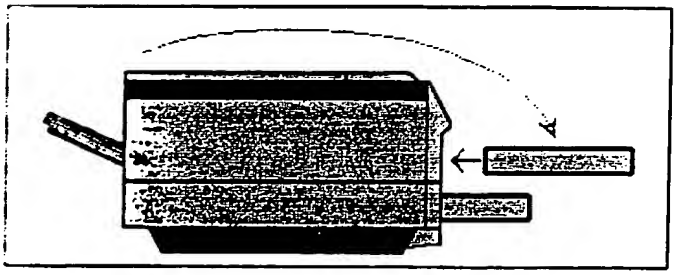

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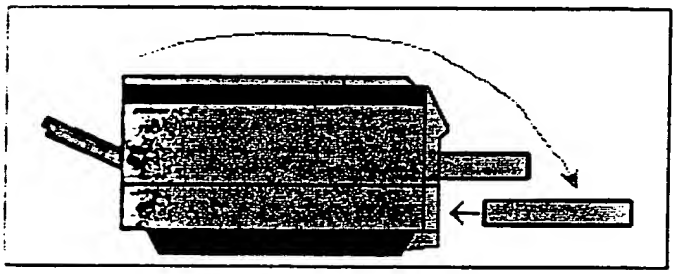
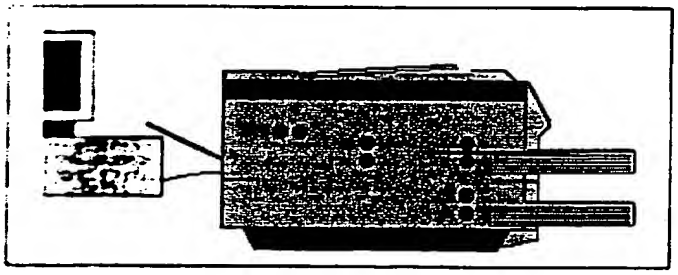


IID Manual Duplex Lower Tray Bitmap



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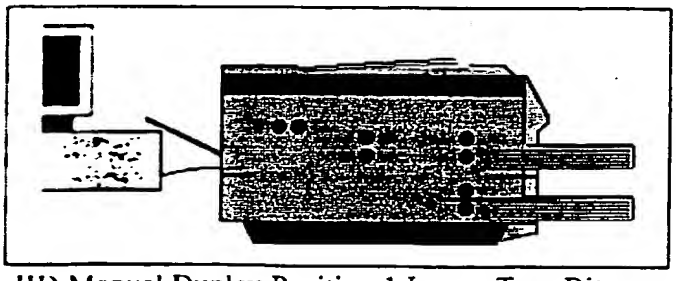
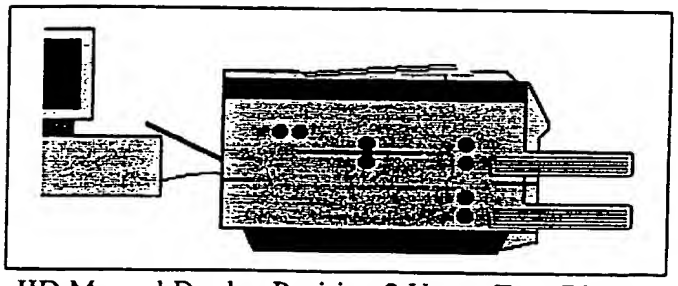


IID Manual Duplex Position 1 Lower Tray Bitmap

Fig. 10B



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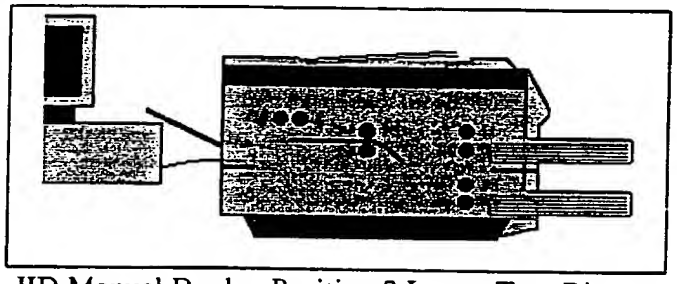
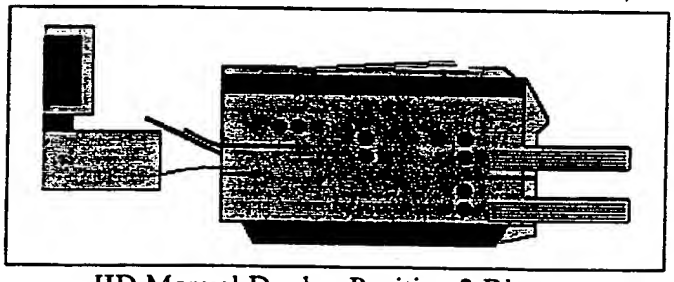


IID Manual Duplex Position 2 Lower Tray Bitmap



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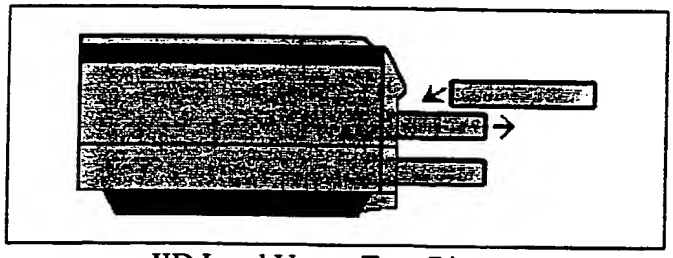
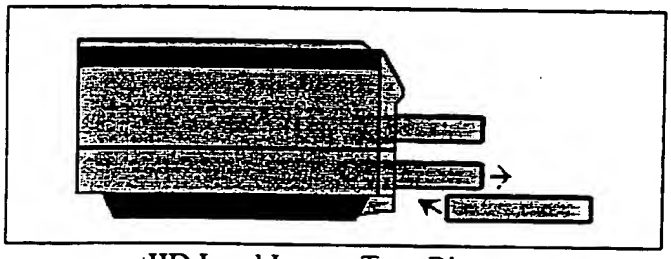
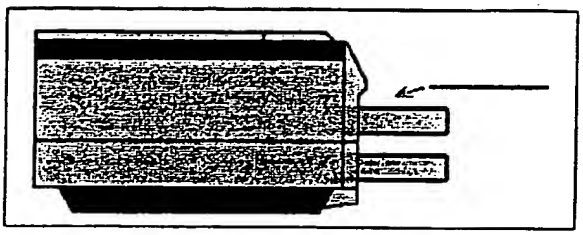


IID Load Upper Tray Bitmap

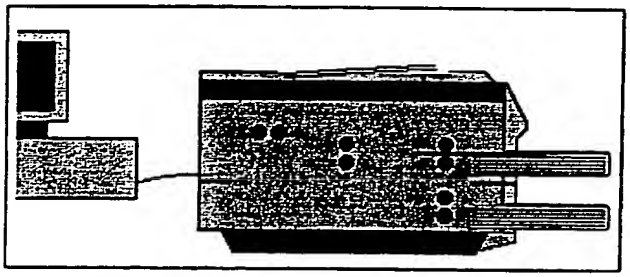


IID Load Lower Tray Bitmap

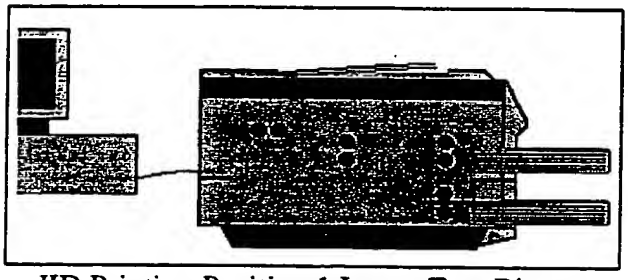
Fig. 10C



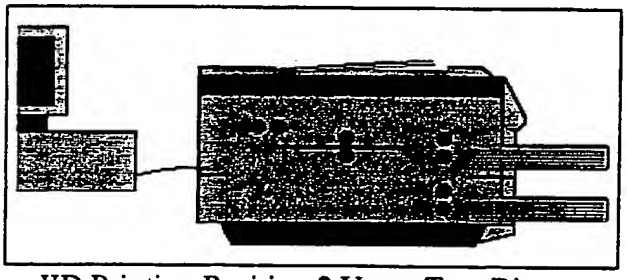
IID Manual Feed Bitmap



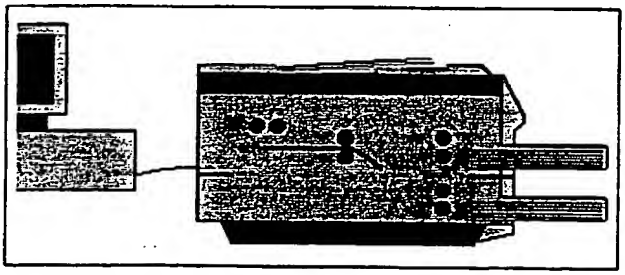
IID Printing Position 1 Upper Tray Bitmap



IID Printing Position 1 Lower Tray Bitmap

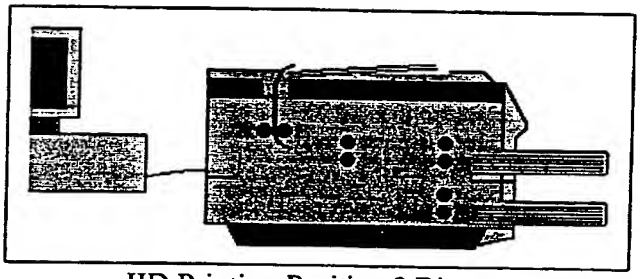


IID Printing Position 2 Upper Tray Bitmap



IID Printing Position 2 Lower Tray Bitmap

Fig. 10D



IID Printing Position 3 Bitmap

Fig. 10E

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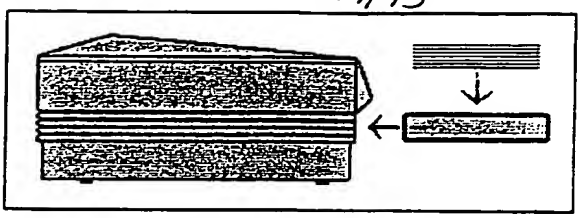
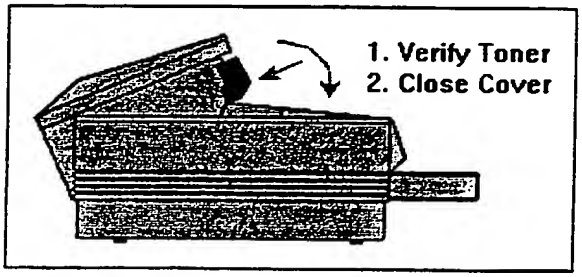
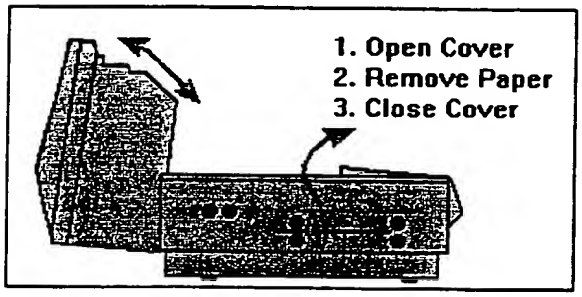


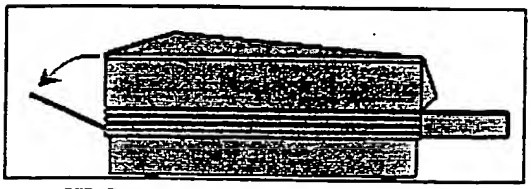
III Add Paper to Tray Bitmap



III Close Cover Bitmap



III Paper Jam Bitmap



III Start Manual Duplex Bitmap

Fig. 11A

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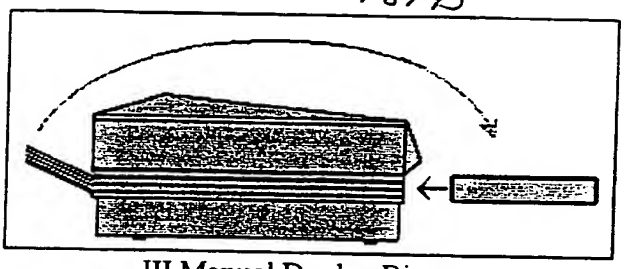
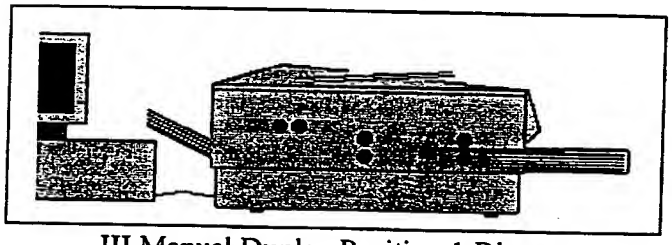
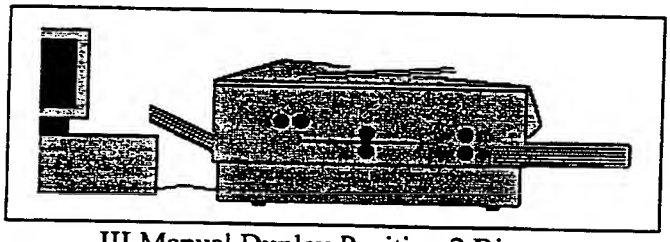


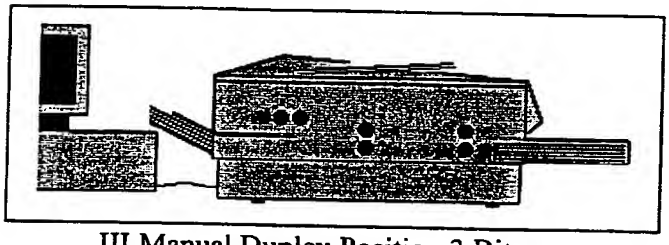
III Manual Duplex Bitmap



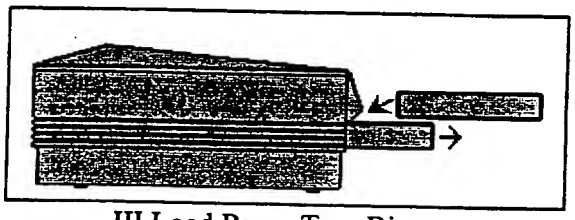
III Manual Duplex Position 1 Bitmap



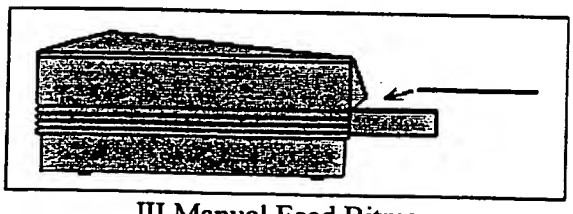
III Manual Duplex Position 2 Bitmap



III Manual Duplex Position 3 Bitmap

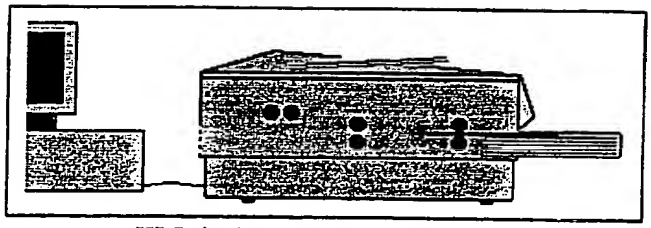


III Load Paper Tray Bitmap

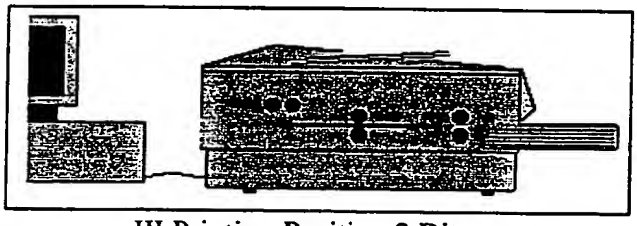


III Manual Feed Bitmap

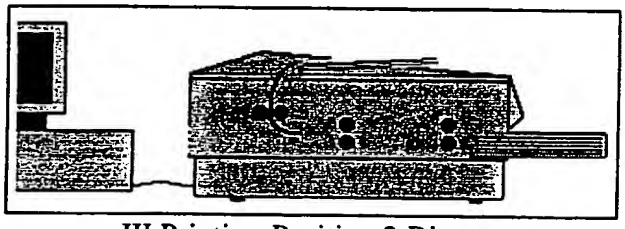
Fig. 11B



III Printing Position 1 Bitmap

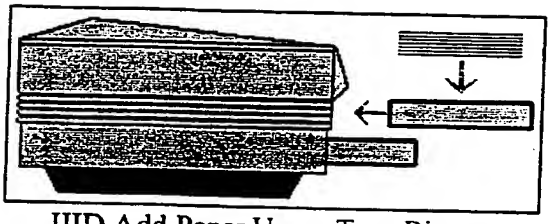


III Printing Position 2 Bitmap

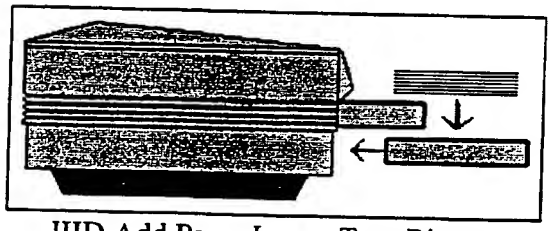


III Printing Position 3 Bitmap

Fig. 11C

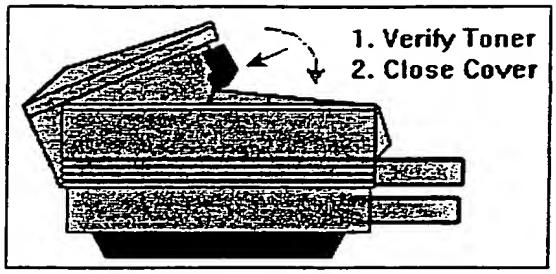


IIID Add Paper Upper Tray Bitmap

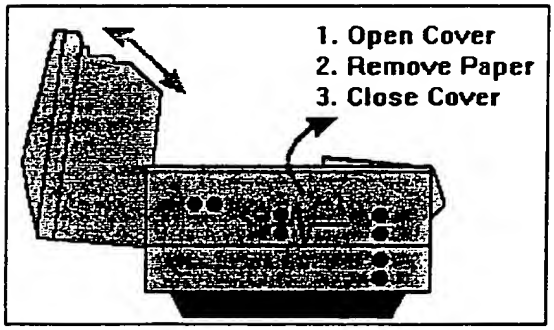


IIID Add Paper Lower Tray Bitmap

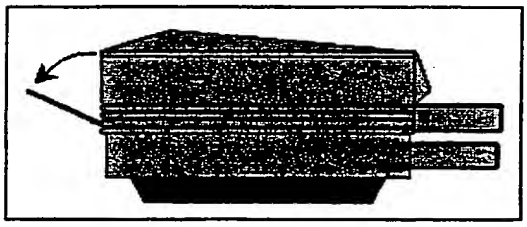
Fig. 12A



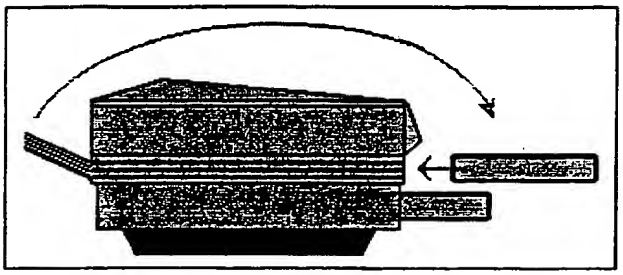
IIID Close Cover Bitmap



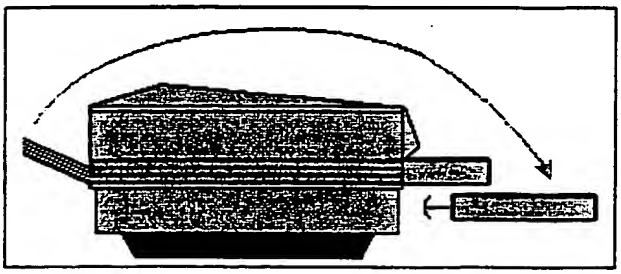
IIID Paper Jam Bitmap



IIID Start Manual Duplex Bitmap

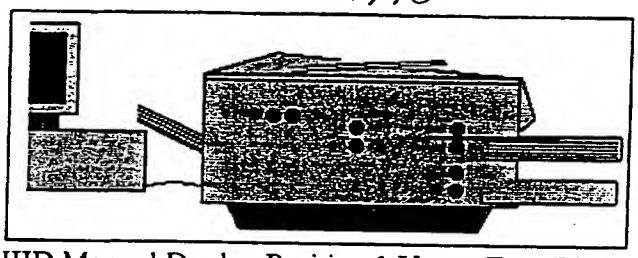


IIID Manual Duplex Upper Tray Bitmap

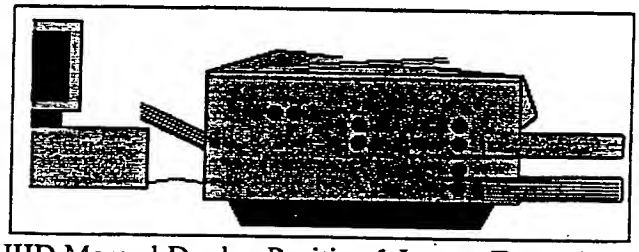


IIID Manual Duplex Lower Tray Bitmap

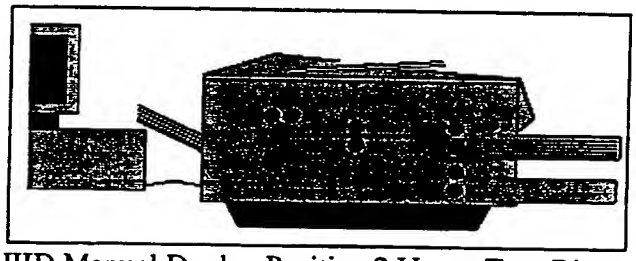
Fig. 12B



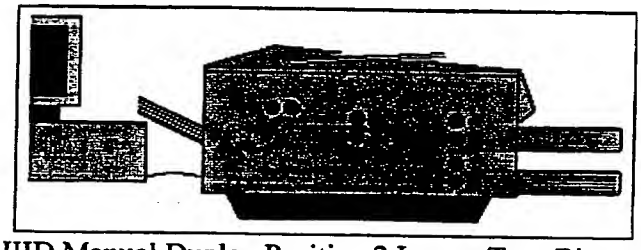
IIID Manual Duplex Position 1 Upper Tray Bitmap



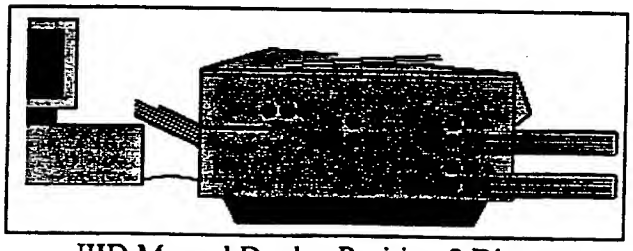
IIID Manual Duplex Position 1 Lower Tray Bitmap



IIID Manual Duplex Position 2 Upper Tray Bitmap

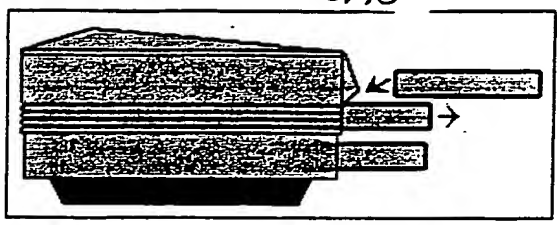


IIID Manual Duplex Position 2 Lower Tray Bitmap

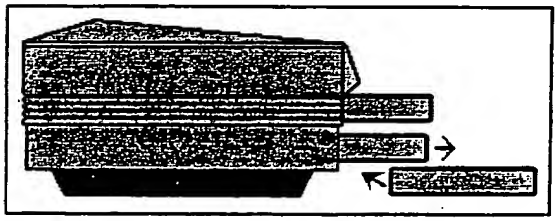


IIID Manual Duplex Position 3 Bitmap

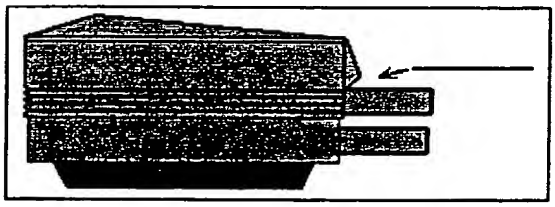
Fig. 12C



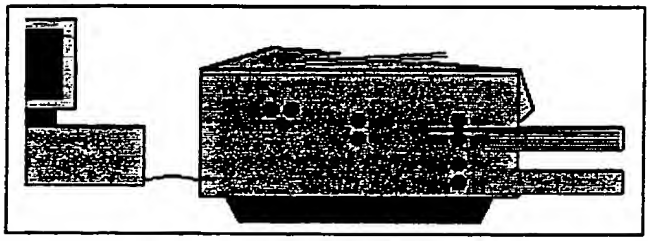
IIID Load Upper Tray Bitmap



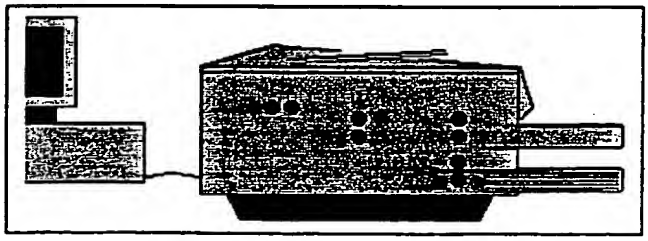
IIID Load Lower Tray Bitmap



IIID Manual Feed Bitmap

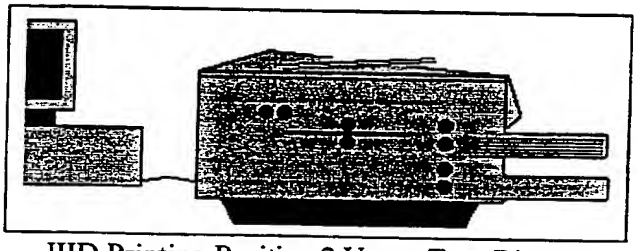


IIID Printing Position 1 Upper Tray Bitmap

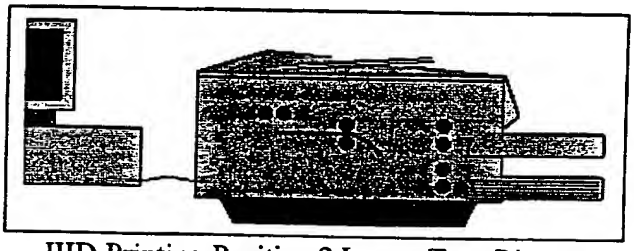


IIID Printing Position 1 Lower Tray Bitmap

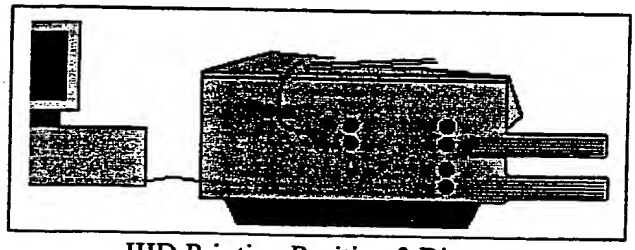
Fig. 12D



IIID Printing Position 2 Upper Tray Bitmap

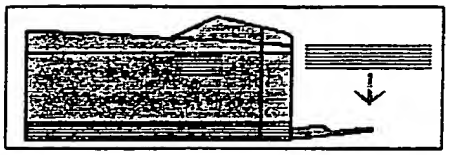


IIID Printing Position 2 Lower Tray Bitmap

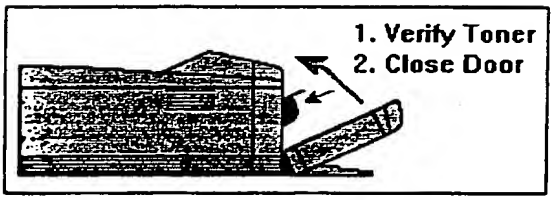


IIID Printing Position 3 Bitmap

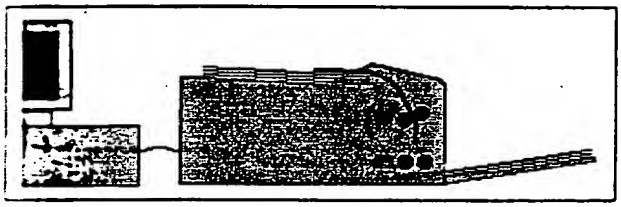
Fig. 12E



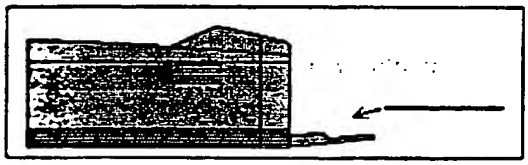
P Add Paper to MP Tray Bitmap



P Close Cover Bitmap

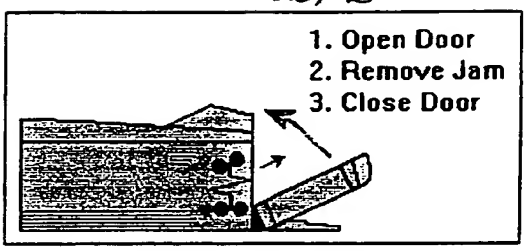


P Printing Position 3 Bitmap

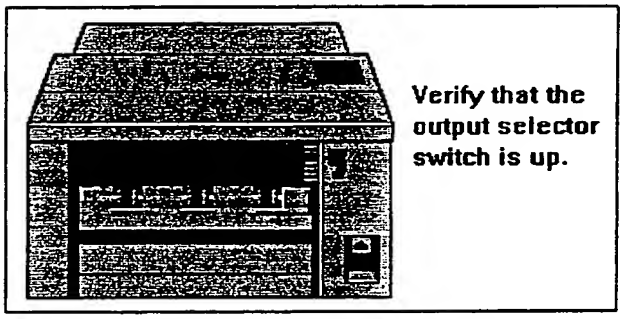


P Manual Feed Bitmap

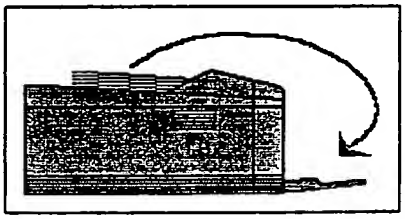
Fig. 13A



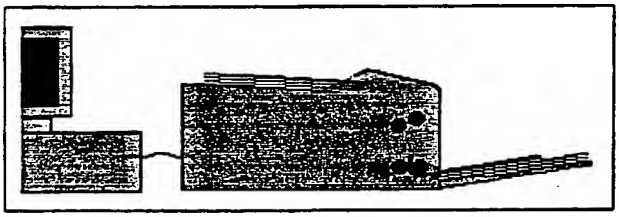
P Paper Jam Bitmap



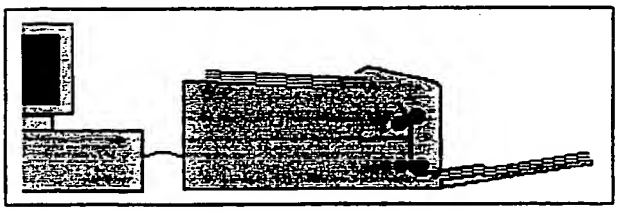
P Start Manual Duplex Bitmap



P Manual Duplex Bitmap

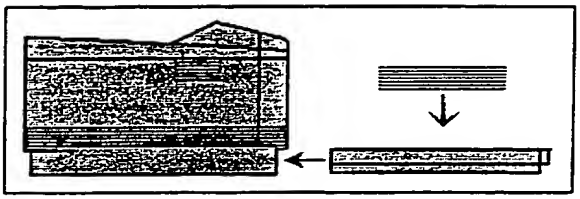


P Printing Position 1 Bitmap

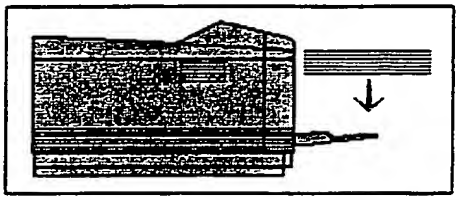


P Printing Position 2 Bitmap

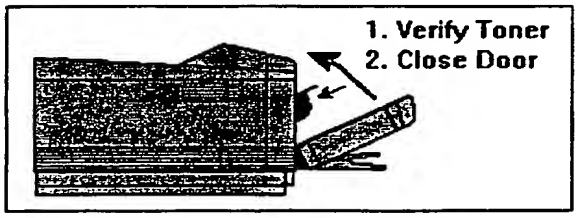
Fig. 13B



P w/LC Add Paper to LC Tray Bitmap

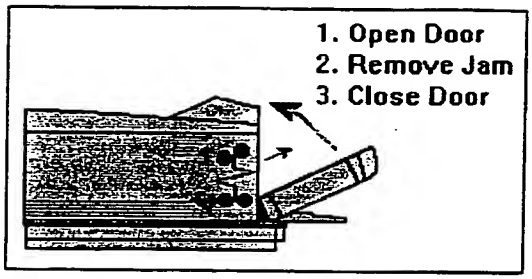


P w/LC Add Paper to MP Tray Bitmap

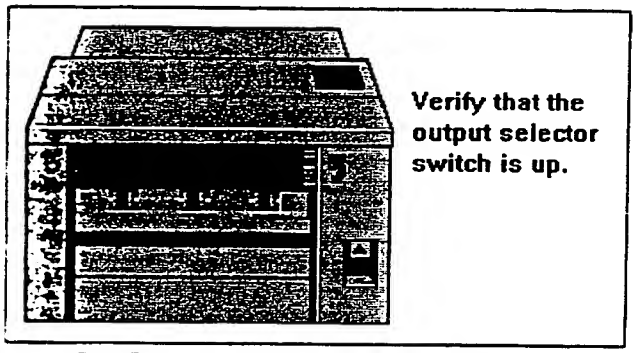


P w/LC Close Cover Bitmap

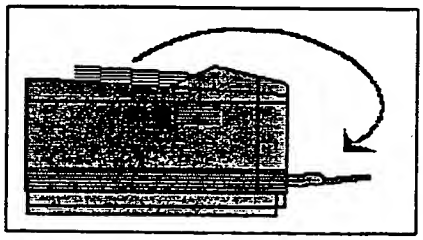
Fig. 14A



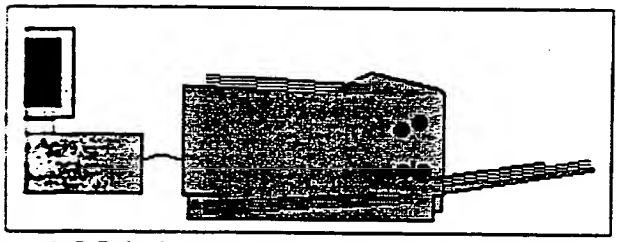
P w/LC Paper Jam Bitmap



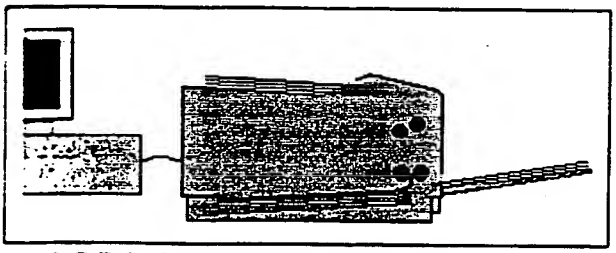
P w/LC Start Manual Duplex Bitmap



P w/LC Manual Duplex Bitmap

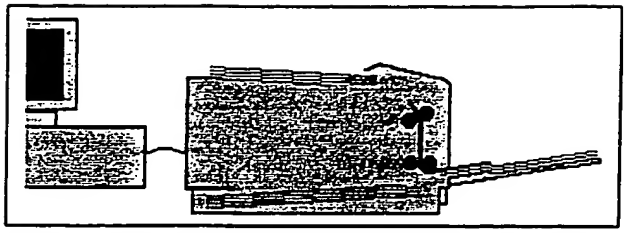


P w/LC Printing Position 1 From MP Tray Bitmap

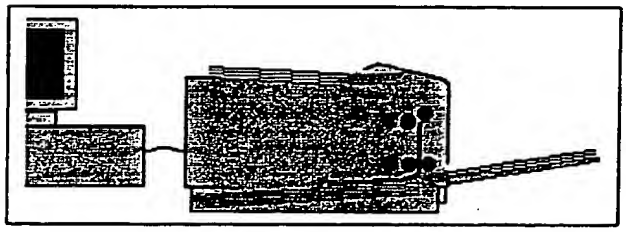


P w/LC Printing Position 1 From LC Tray Bitmap

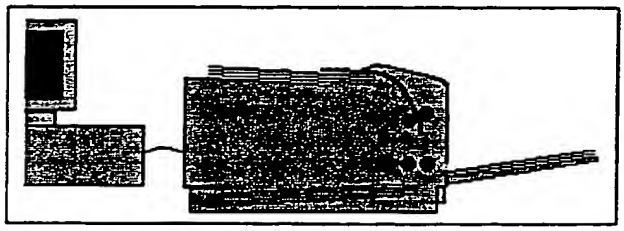
Fig. 14B



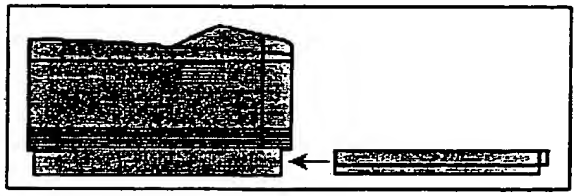
P w/LC Printing Position 2 From MP Tray Bitmap



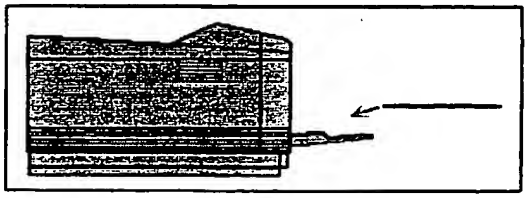
P w/LC Printing Position 2 From LC Tray Bitmap



P w/LC Printing Position 3 Bitmap



P w/LC Load LC Tray Bitmap



P w/LC Manual Feed Bitmap

Fig. 14C

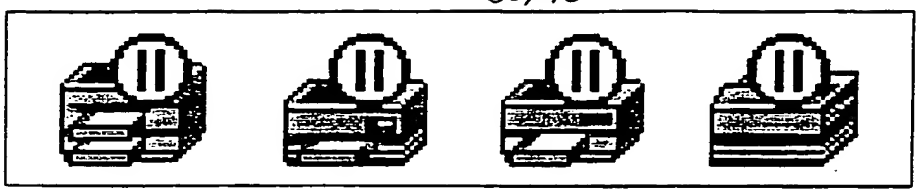


Fig. 15A

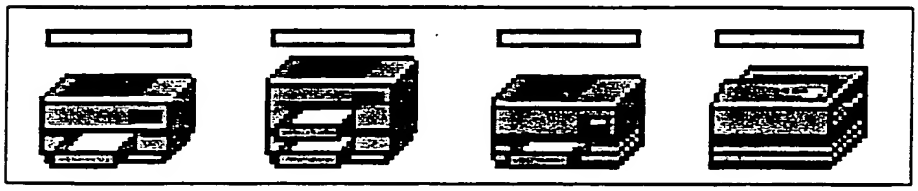


Fig. 15B

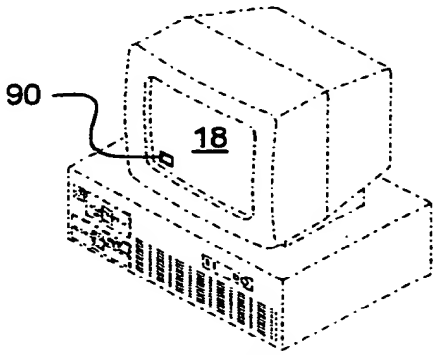


Fig. 15C

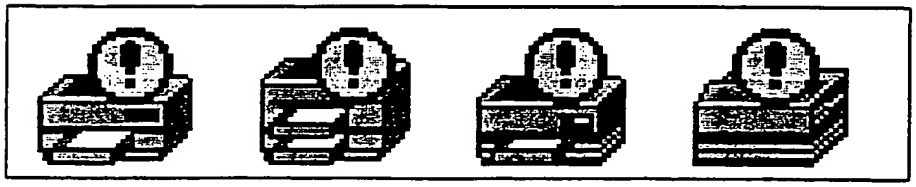


Fig. 15D

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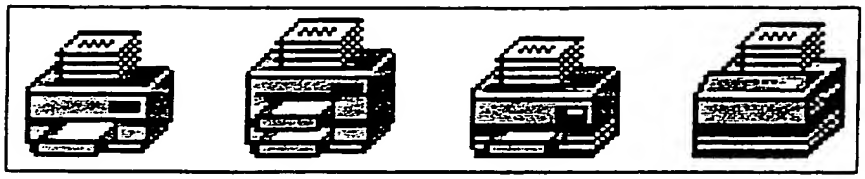

Fig. 15E

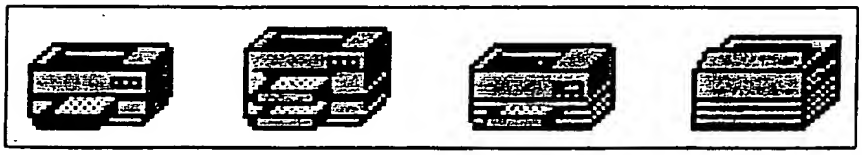

Fig. 15F

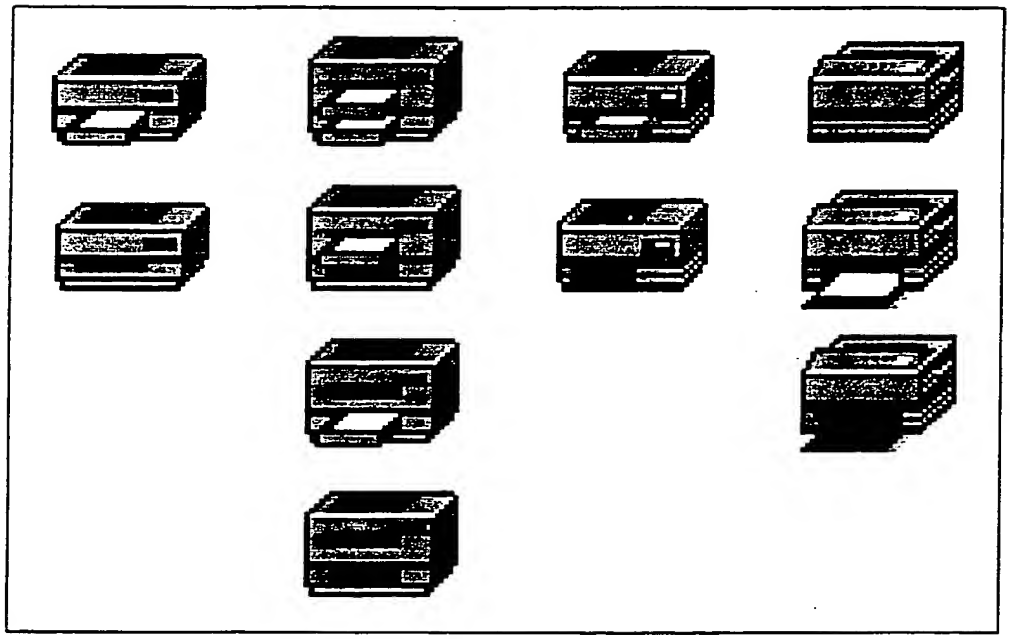

Fig. 15G

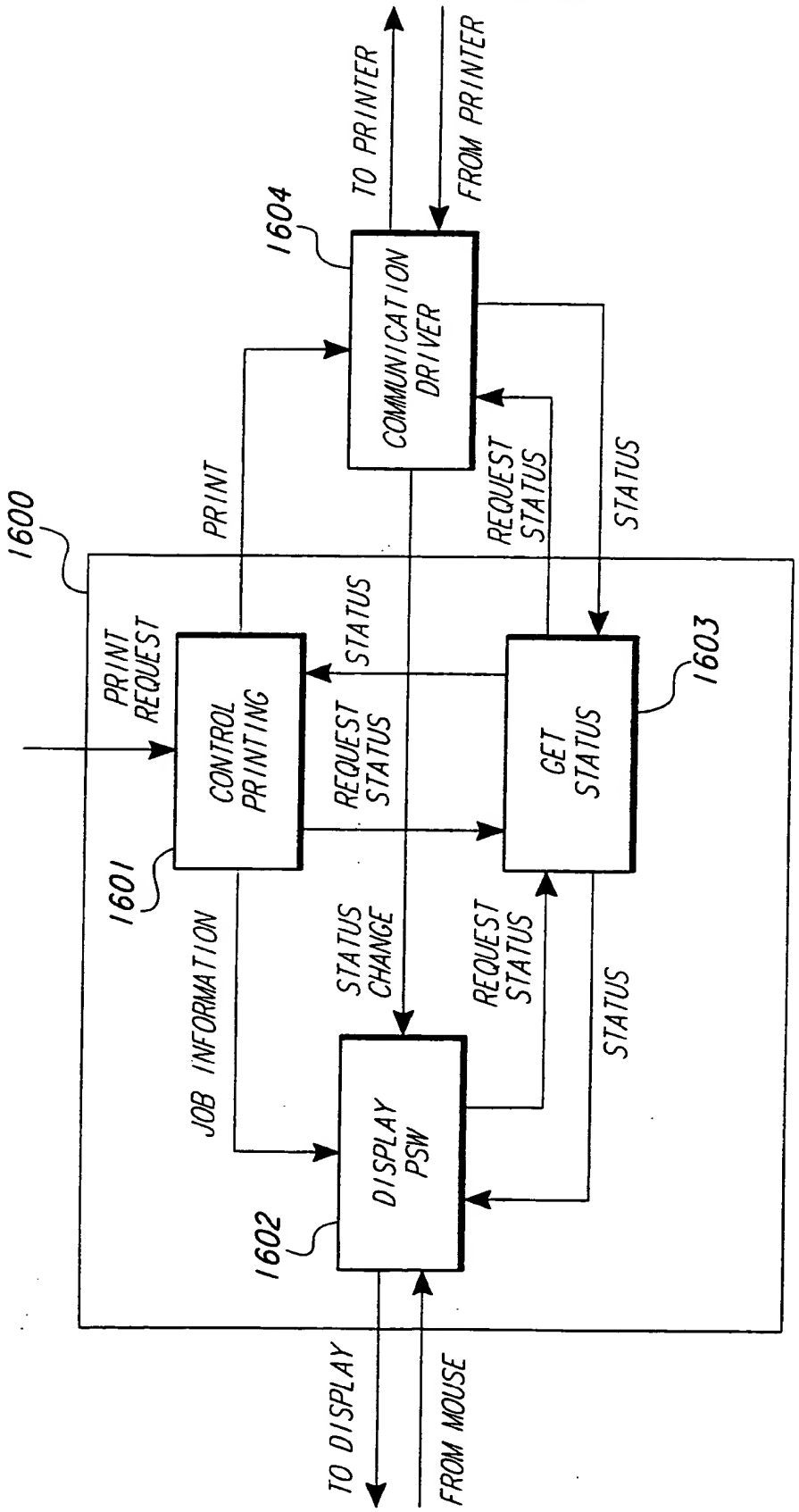

Fig. 16

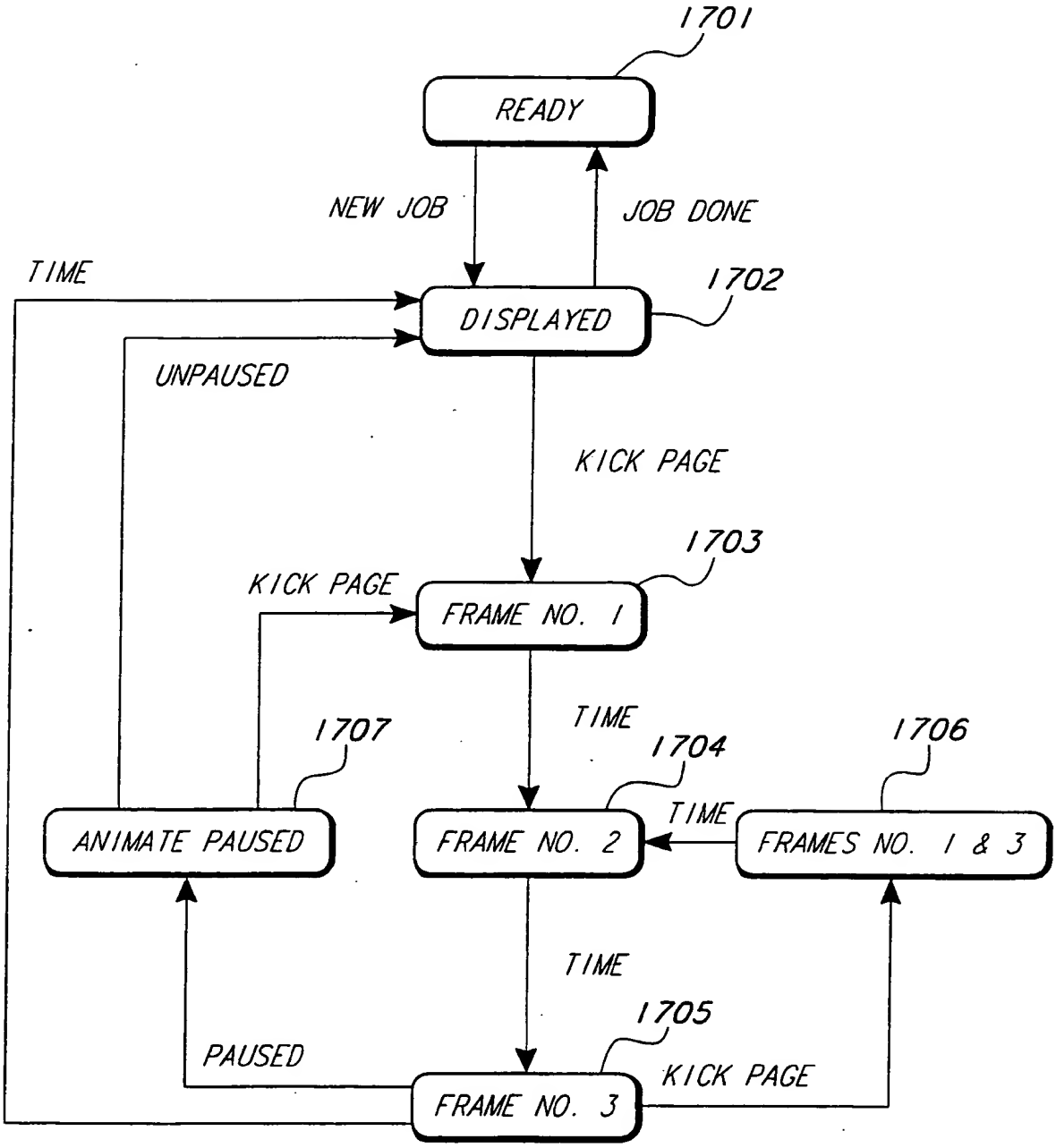

Fig. 17

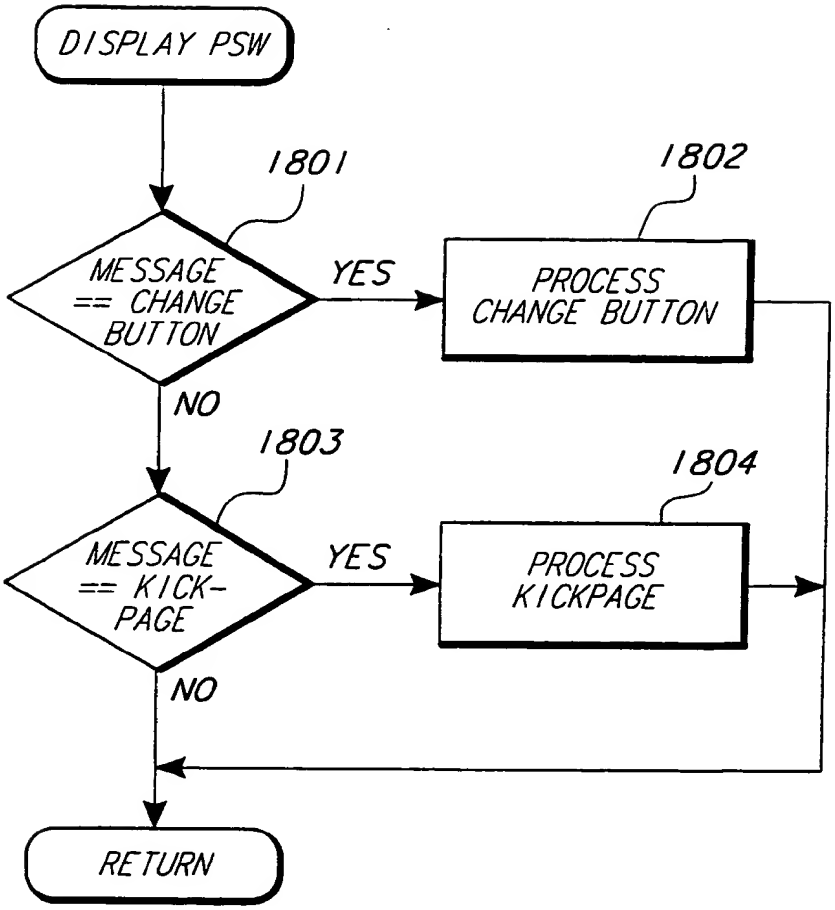

Fig. 18

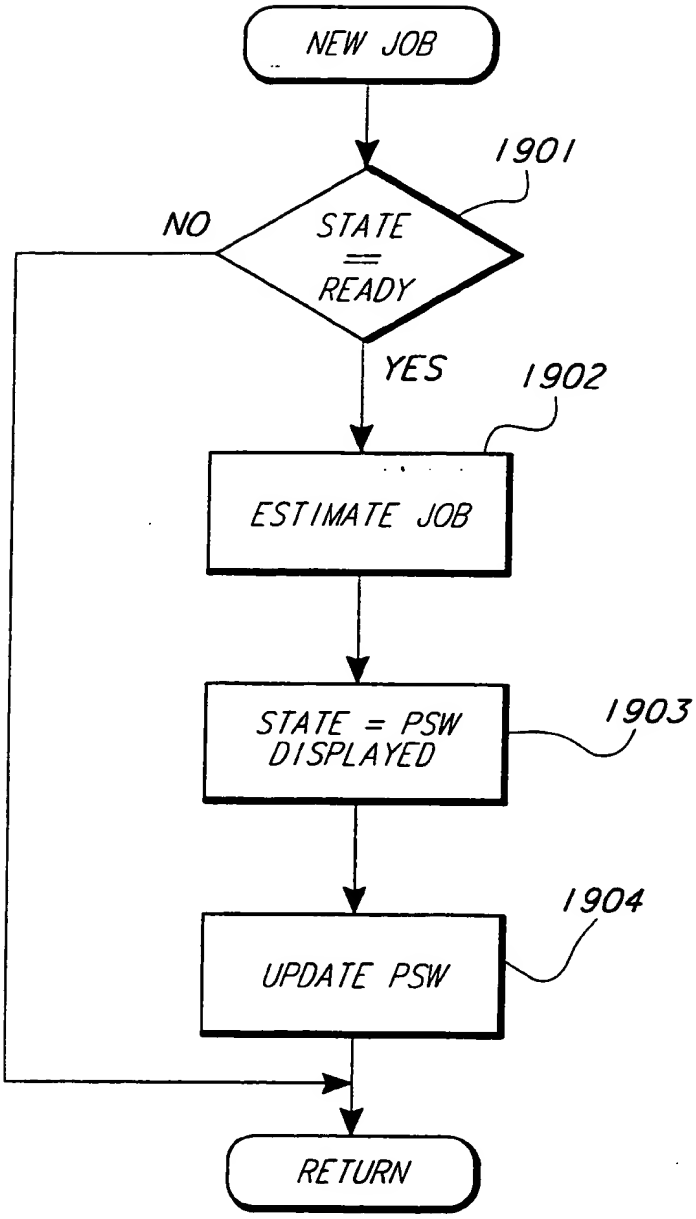

Fig. 19

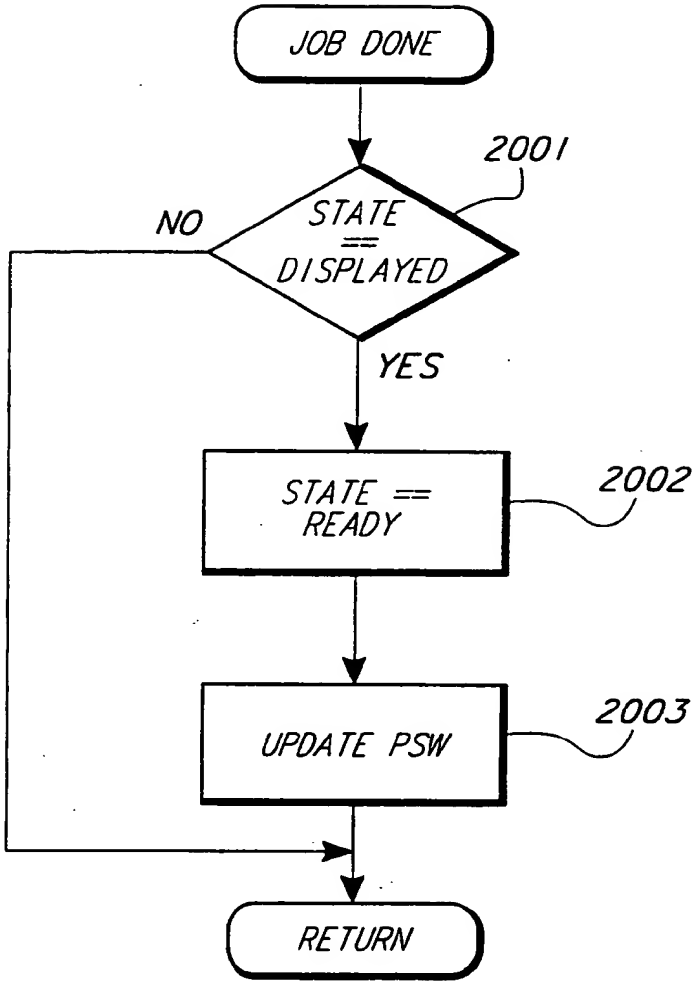

Fig. 20

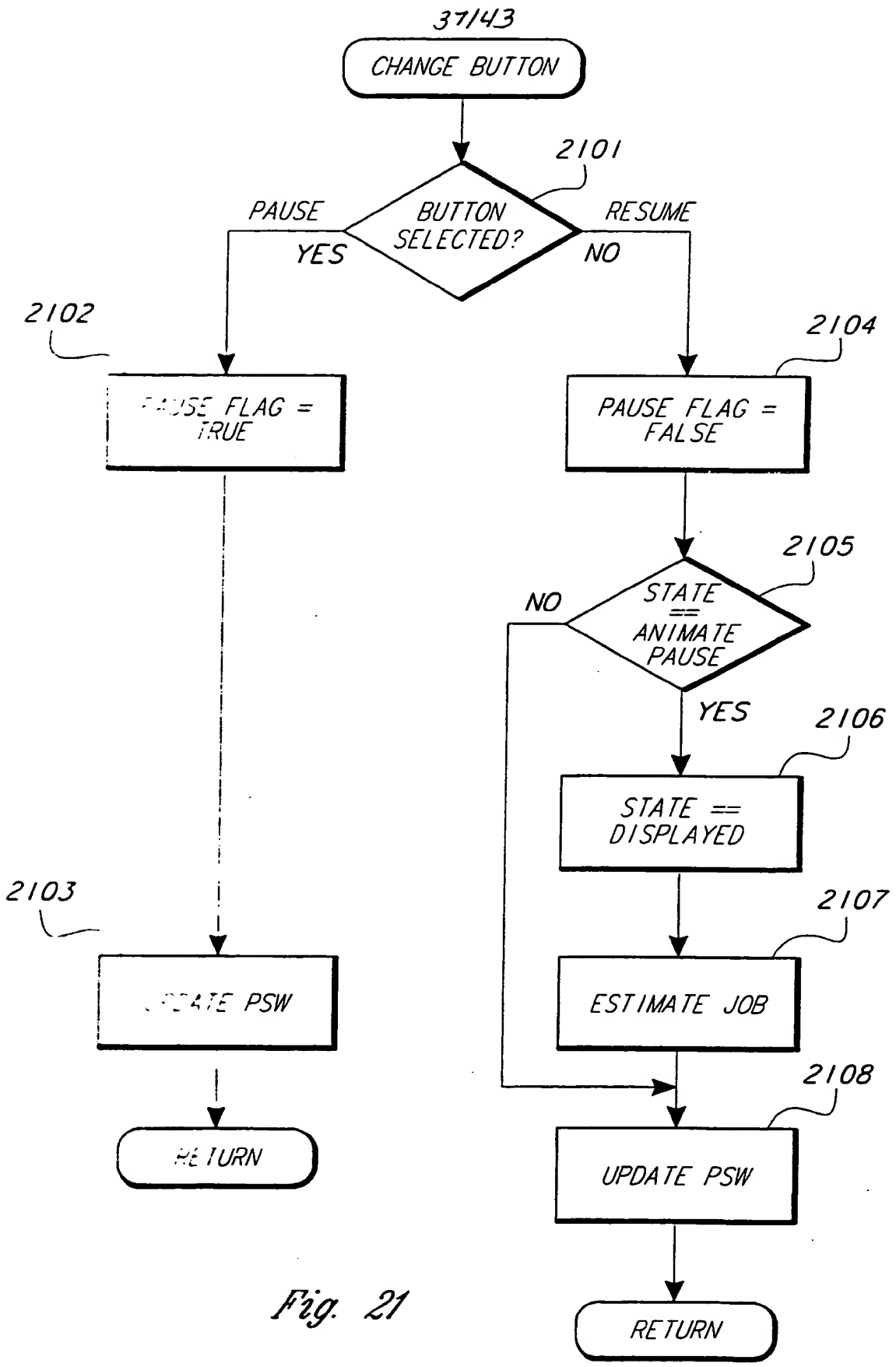

Fig. 21

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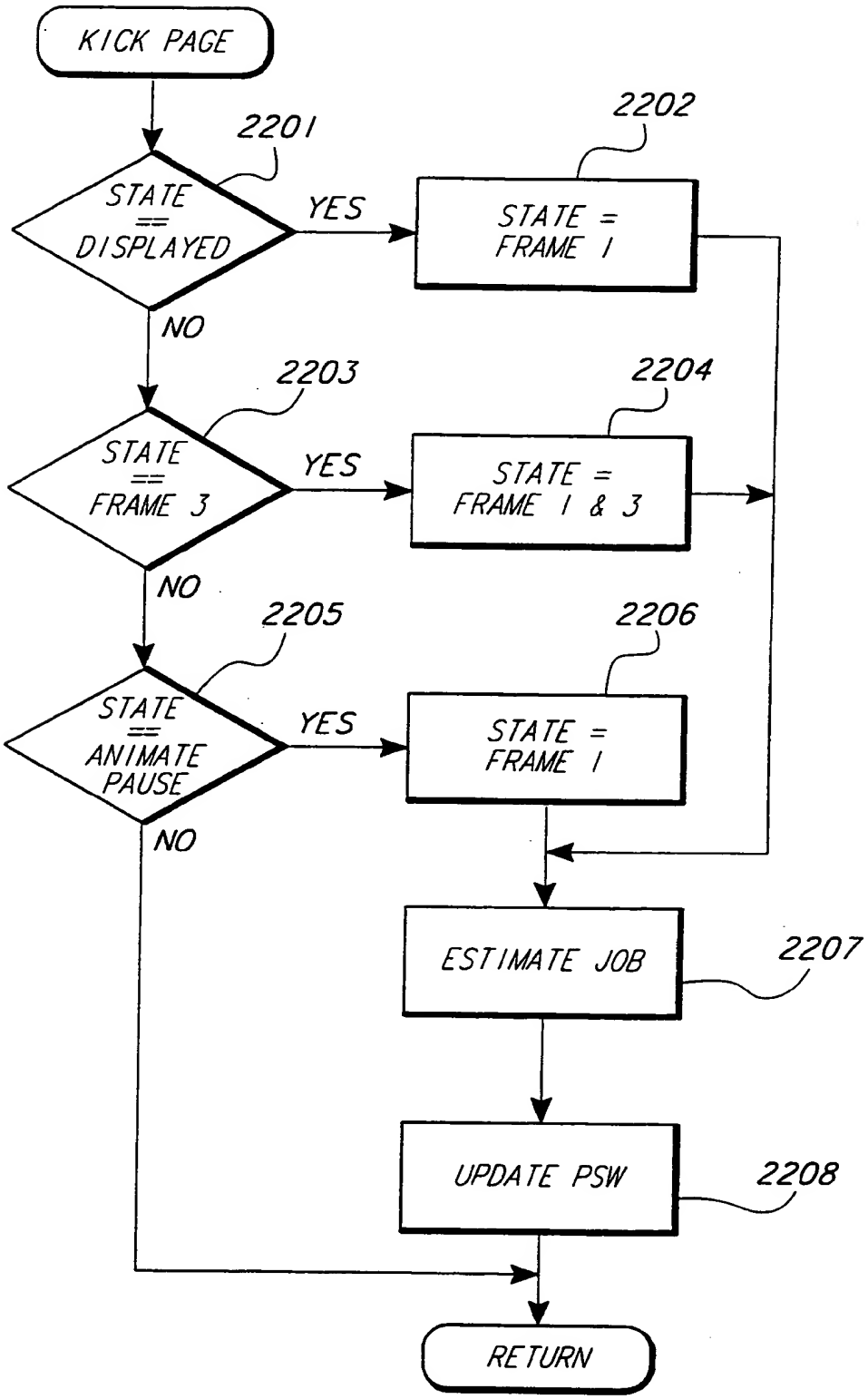


Fig. 22

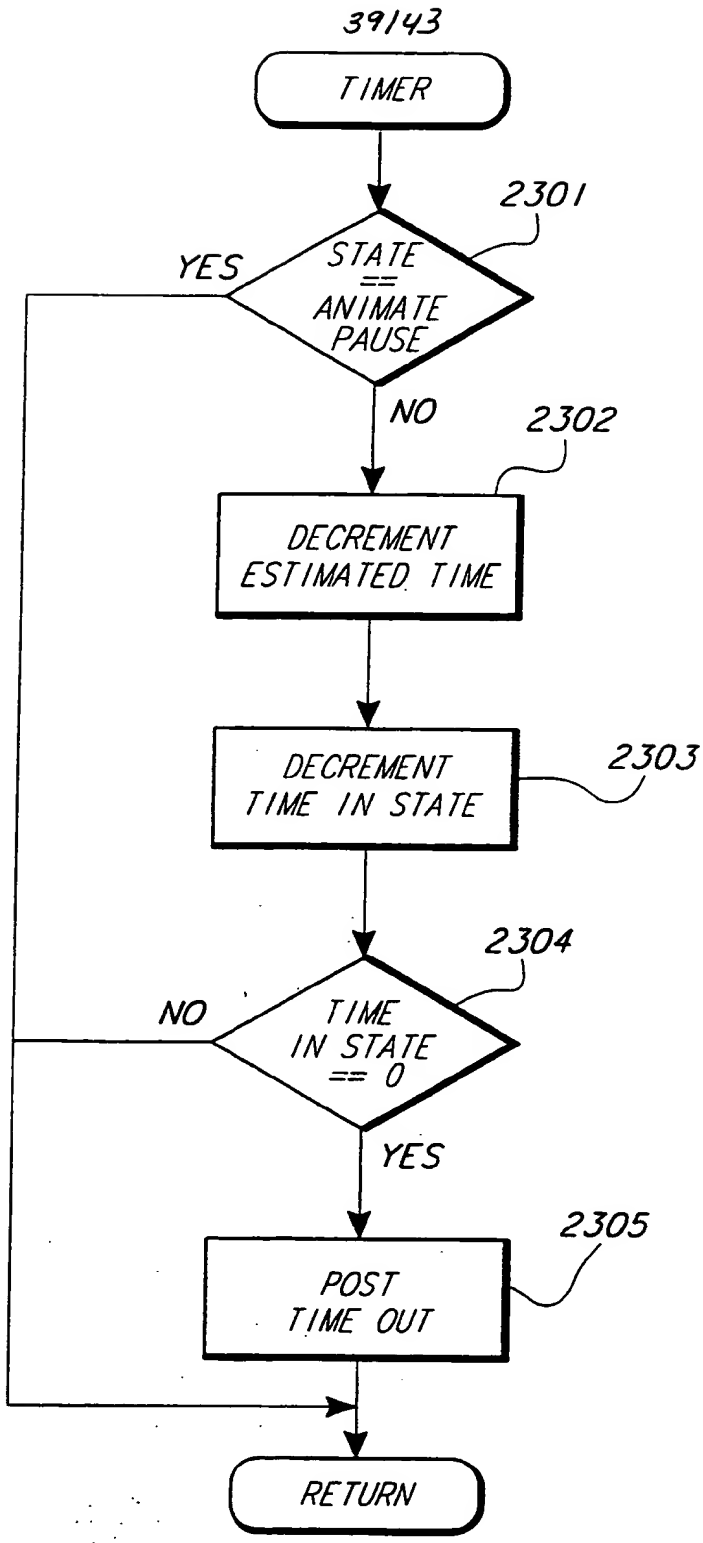
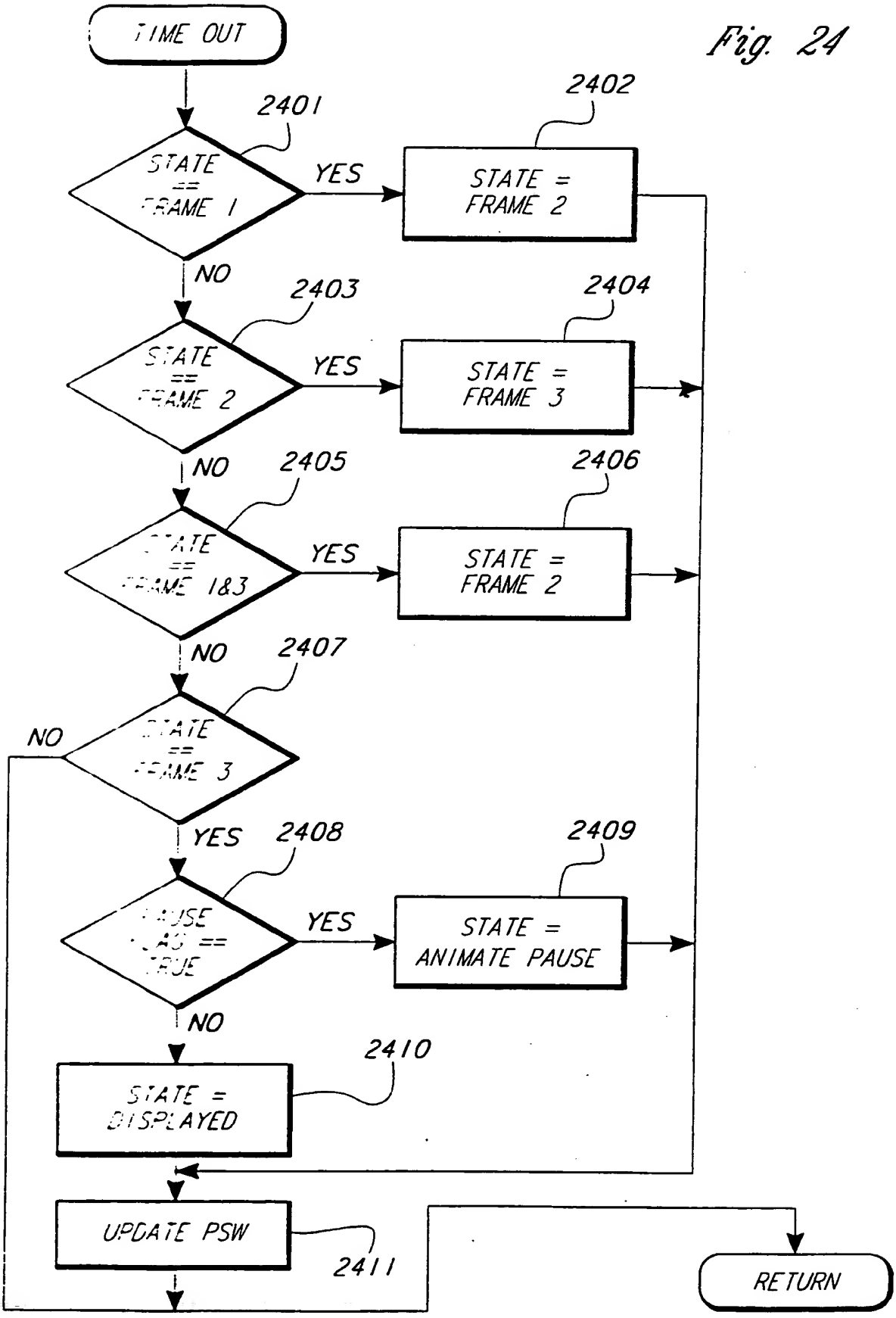


Fig. 23

Fig. 24



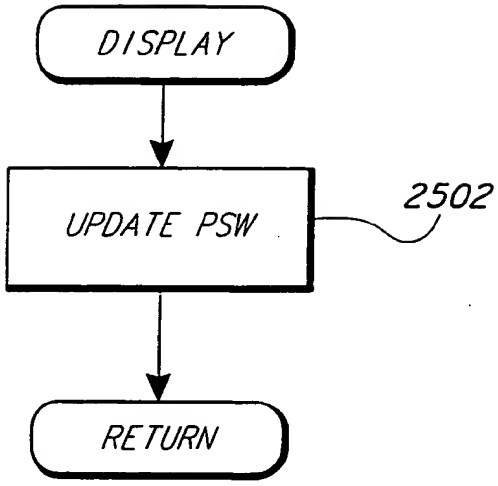


Fig. 25

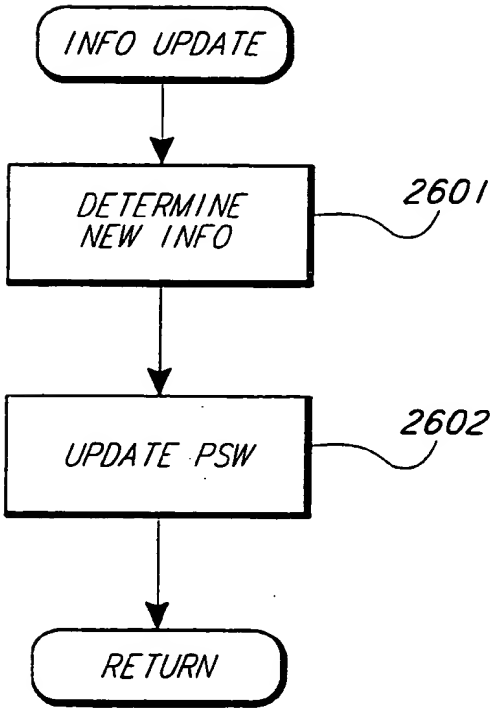


Fig. 26

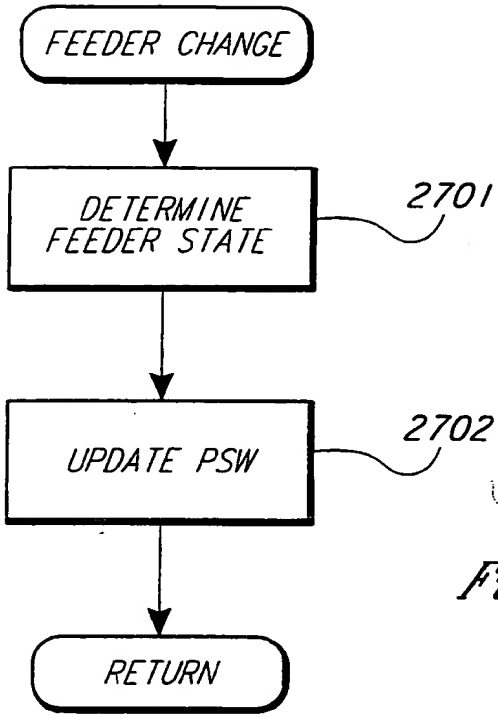


Fig. 27

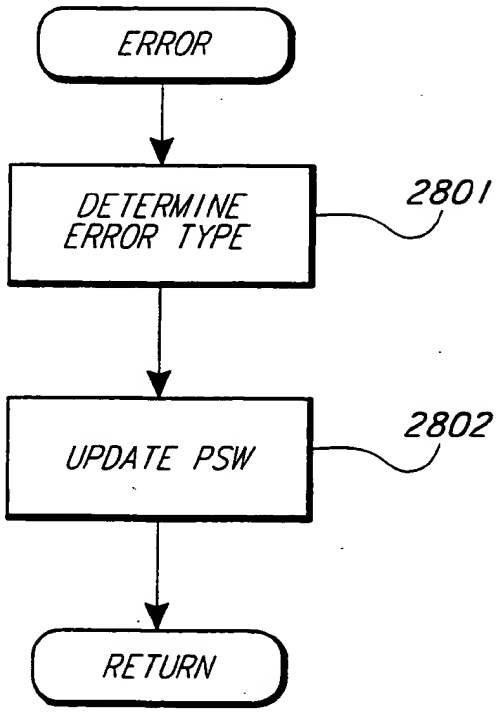


Fig. 28

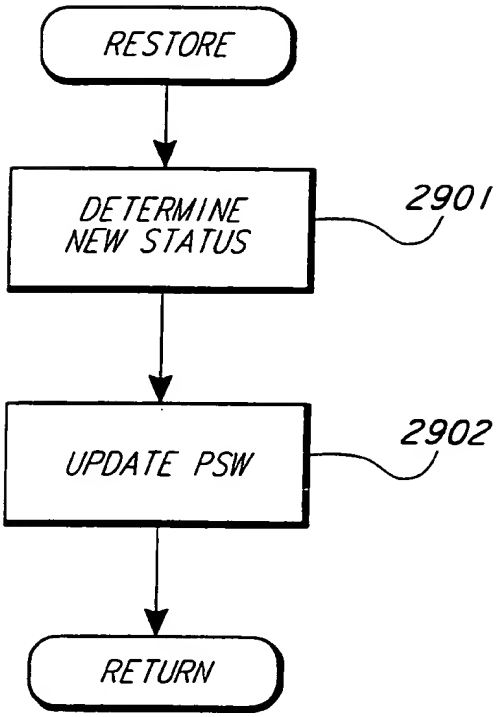


Fig. 29

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/US 93/10856

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 G06F3/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 5 G06F G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP,A,0 479 494 (XEROX CORPORATION) 8 April 1992 see figures 1A,1B,9,10 see column 7, line 34 - column 8, line 23	1-3,7,11
A	EP,A,0 444 251 (HEWLETT-PACKARD COMPANY) 4 September 1991 see figures 1-5 see column 3, line 12 - line 49	1-3,5,7, 10,11
A	IBM TECHNICAL DISCLOSURE BULLETIN. vol. 34, no. 1 , June 1991 , NEW YORK US pages 266 - 269 'GRAPHIC OFFICE INTERFACE' see figures 1-3 see page 266, right column, line 26 - line 29	1,5,7,9, 11

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 March 1994	31. 03. 94

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Weiss, P

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter nal Application No
PCT/US 93/10856

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A-0479494	08-04-92	US-A-	5133048	21-07-92
		CA-A-	2048536	29-03-92
		JP-A-	4361083	14-12-92
EP-A-0444251	04-09-91	NONE		

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